



Administrative Settlement Agreement and Order on Consent for Removal Action

In re: Statoil Eisenbath Well Pad Site

Clarington, Ohio, Docket No. V-W-14-C-012

Report for Paragraph 15.a.ii

Submitted July 22, 2015

Table of Contents

EXECUTIVE SUMMARY	1
1.0 INTRODUCTION	2
1.1 Work Scope Summary	2
1.2 Sample Types Collected	2
1.3 Sample Locations	3
2.0 SURFACE WATER AND SEDIMENT EVALUATION	5
2.1 Pad and Impoundment	8
2.2 Unnamed Tributary to Opossum Creek	9
2.3 Opossum Creek	11
2.4 Ohio River	13
2.5 Summary Trends	14
3.0 QUALITY ASSURANCE/QUALITY CONTROL	14
4.0 CONCLUSIONS	16

Tables

- Table 1: WSSSAAP Surface Water Sampling Locations
- Table 2: 15.a.ii Sample Location Summary
- Table 3: Background Samples with Detections of TTPC
- Table 4: Pad and Impoundment Location Summary
- Table 5: Unnamed Tributary Location Summary
- Table 6: Opossum Creek Location Summary
- Table 7: Ohio River Location Summary

Appendices

- Appendix A: Master Summary
 - A.1 Figure 1
 - Master Location Summary Map
 - A.2 Master Trend Graphs: Surface Water
 - A.3 Master Trend Graphs: Sediment
- Appendix B: Impoundment Location
 - B.1 Figure 2
 - Impoundment Location Summary Map
- Appendix C: Unnamed Tributary to Opossum Creek
 - C.1 Figure 3
 - Unnamed Tributary Location Summary Map
 - C.2 Unnamed Tributary Trend Graphs: Surface Water
 - C.3 Unnamed Tributary Trend Graphs: Sediment
- Appendix D: Opossum Creek
 - D.1 Figure 4
 - Opossum Creek Location Summary Map
 - D.2 Opossum Creek Trend Graphs: Surface Water
 - D.3 Opossum Creek Trend Graphs: Sediment
- Appendix E: Ohio River
 - E.1 Figure 5
 - Ohio River Location Summary Map
 - E.2 Ohio River Trend Graphs: Surface Water
 - E.3 Ohio River Trend Graphs: Sediment
- Appendix F: Lab Results

EXECUTIVE SUMMARY

The following report contains the results of Statoil's evaluation of data collected from monitoring, sampling, and assessment activities of the surface waters and sediments within an unnamed tributary to Opossum Creek, Opossum Creek, and a portion of the Ohio River from the confluence with Opossum Creek to the first downstream public water intake ("areas of investigation"). The surface waters and sediments within these areas were monitored, sampled, and assessed in the context of certain chemical constituents identified in the *Environmental Sampling and Analysis Plan* (SAP), Version 1.7, ("SAP constituents") pursuant to Paragraph 15.a.ii of the Administrative Settlement Agreement and Order on Consent for Removal Action ("AOC"), Docket No. V-W-14-C-012, between Statoil USA Onshore Properties, Inc. (Statoil) and the United States Environmental Protection Agency (US EPA) (effective August 20, 2014). This report is submitted pursuant to Paragraphs 15.b of the AOC.

Pursuant to the AOC and the approved Work Plan, this report contains the results of Statoil's evaluation of data collected from surface water and sediment sampling locations between June 29, 2014 and April 8, 2015.

On April 3, 2015, US EPA authorized Statoil to cease monitoring activities under the Water, Soil, and Sediment, Sampling and Adjustment Plan (WSSSAAP). Statoil continued to sample under the WSSSAAP until April 8, 2015. Accordingly, all data collected during the SAP and WSSSAAP programs from the unnamed tributary to Opossum Creek, Opossum Creek, and the Ohio River, up to and beyond March 2, 2015, is included in this assessment. Sampling and analysis of sediment and surface water samples from June 29, 2014 through April 8, 2015 indicate that SAP constituents were either not present in the areas of investigation, have naturally attenuated, or are naturally attenuating.

Data collected indicated there were initial short term detections at or above screening levels of some SAP constituents within the unnamed tributary to Opossum Creek and within Opossum Creek, but for most SAP constituents these detections diminished rapidly after the fire at the pad was extinguished. TTPC levels, however, have fluctuated in the surface water and sediment of the unnamed tributary to Opossum Creek. Water quality and sediment sampling data indicates no detections of SAP constituents in the Ohio River downstream of the confluence of Opossum Creek to the first public water intake associated with the Eisenbarth Well Pad incident.

1.0 INTRODUCTION

This report, prepared by Moody and Associates, Inc. (Moody) on behalf of Statoil USA Onshore Properties, Inc. (Statoil) and in accordance with Paragraphs 15.a.ii. and 15.b. of the AOC, and the Work Plan approved pursuant to Paragraph 16 of the AOC, provides a comprehensive evaluation of data generated from monitoring, sampling, and assessment activities of the surface waters and sediments within three (3) waterways, or “areas of investigation”, for chemical constituents identified in the *Environmental Sampling and Analysis Plan* (SAP), Version 1.7 (“SAP constituents”). The areas of investigation consist of an unnamed tributary to Opossum Creek, Opossum Creek, and a portion of the Ohio River from the confluence with Opossum Creek to the first downstream public water intake. Surface water and sediment sample locations evaluated for this report are included on **Figure 1 in Appendix A**.

This report provides a comprehensive analysis and evaluation of data generated from sediment and surface water samples, field observations, and other relevant information to determine the presence of SAP constituents in the areas of investigation.

1.1 Work Scope Summary

Surface water and sediment sampling efforts commenced under Unified Command guidance on June 29, 2014. Environmental water and sediment quality sampling was conducted under the SAP that was reviewed by Unified Command on July 2, 2014 and revised on July 13, 2014. The SAP is considered to run from June 29, 2014 to July 17, 2015. Sampling under the reviewed *Water, Soil, and Sediment Sampling and Analysis Adjustment Plan* (WSSSAAP) was conducted from July 18, 2014 to April 8, 2015.

Analytical values were compared to screening values derived from US EPA and OEPA guidance in accordance with ecological risk assessment guidelines. Several target analytes in water, sediment, and soil were found in background samples and as such were eliminated from the sampling program. Sampling for these background constituents continued under the SAP until the implementation of the WSSSAAP on July 18, 2014.

Under the WSSSAAP, all analytes from the previous SAP program that met one or more of the following criteria were eliminated from the sampling program:

- The analyte had not exceeded screening levels
- The analyte was not detected in greater than 10% of collected samples
- The analyte was determined to naturally exceed screening levels

Two constituents met this criteria: acetone and chlorides. However, as further discussed below, TPH and TTPC were also monitored under the WSSSAAP. Accordingly, these four constituents are the SAP constituents evaluated in this report, as these are the only SAP constituents with sampling data beyond July 18, 2014.

1.2 Sample Types Collected

Pursuant to the SAP, sampling was performed daily for surface water and periodically for sediment from June 29, 2014 to July 17, 2014. Due to weather and safety stand downs, all fixed sampling locations were

not sampled every day. However, surface water sampling occurred on the majority of days during which the SAP was in effect.

Upon establishment of the WSSSAAP, sediment sampling was performed along the adjacent unnamed tributary to Opossum Creek and along Opossum Creek after a rain event of 0.5 inches or more within a 24 hour period. Sediment and water sampling along the Ohio River was discontinued with the establishment of the WSSSAAP on July 18, 2014.

During the period of the WSSSAAP program from July 18, 2014 to April 8, 2015, water quality samples from the locations on Opossum Creek and the unnamed tributary to Opossum Creek were collected on a three (3) day rotation while the Eisenbarth Well Pad containment remained in place until US EPA authorized Statoil to (1) cease the WSSAAP monitoring activities and (2) cease the containment activities. **Table 1** identifies the locations that were sampled every three days under the WSSSAAP, and those that were sampled as needed or when changes in status of odor, water flow, and water quality were observed.

Table 1
WSSSAAP
Sampling Locations

Rotation Group	Area	Associated Location IDs
Day 1	Eisenbarth Well Pad	PD03, PD07, SW24 (previously evaluated in 15.a.i)
Day 2	Unnamed Tributary to Opossum Creek	SW06, SW17, SW18, SW21, SW25
Day 3	Opossum Creek	SW20, SW04, SW08
Background (As Needed)	Various	SW12, SW14, SW23
Additional (As Needed)	Eisenbarth Well Pad	PD10, PD11, SW03 (previously evaluated in 15.a.i)

1.3 Sample Locations

Statoil provided a list of sediment and surface water sample locations in the *Draft Work Plan* submitted to US EPA on December 23, 2014. Some monitoring locations that were provided in *Table 3* of the December 23, 2014 *Draft Work Plan* were later determined to not be relevant to Paragraph 15.a.i and the related evaluation required by Paragraph 15.b. These monitoring stations are instead considered to be representative of the water quality and sediments in the unnamed tributary to Opossum Creek, Opossum Creek, and the Ohio River, and are referenced as such herein. See Report for Paragraph 15.a.i. on page 5 (submitted May 27, 2015).

All monitoring locations established and sampled between June 29, 2014 and April 8, 2015 were evaluated in terms of their applicability to each of the three Work Plan scopes (Paragraphs 15.a.i, 15.a.ii, and 15.a.iii of the AOC). Monitoring locations that are applicable to the evaluation required by 15.a.ii are herein divided into three subsets:

- Locations associated with the unnamed tributary to Opossum Creek (SW18, SW17, SW17U, SW17D, SW25, SW06, SW23, SW21, and SW19)
- Locations associated with Opossum Creek (SW08, SW15, SW12, SW20, SW14, SW04, and SW11)
- Locations associated with the Ohio River (SW22, SW07, SW09, SW16, and SW10)

One pond/impoundment water sample location (PW05) has been included in the 15.a.ii evaluation (**Table 2**). Surface water (SW) samples that were outside of the immediate Eisenbarth Well Pad area were also considered to be relevant to the 15.a.ii evaluation and are included on **Table 2**. SW26 and SW27, which were waste characterizations samples, were not included in this evaluation nor were specific constituent sampling locations (BE-9, HCL, GB001, FR) that were used for chemical identification of potential contaminants.

Table 2
15.a.ii Sample Location Summary

Location ID	Latitude	Longitude	Receptor
PW05	39.69700241	-80.90020752	Pond/Impoundment Water
SW04	39.71111618	-80.88783056	Opossum Creek
SW06	39.69456482	-80.90405273	Unnamed Tributary to Opossum Creek
SW07	39.7629090	-80.8705560	Ohio River - Background
SW08	39.73865509	-80.85214996	Opossum Creek
SW09	39.72792053	-80.84043884	Ohio River
SW10	39.66869354	-80.86100769	Ohio River
SW11	39.71075302	-80.88822216	Opossum Creek - Background
SW12	39.71466093	-80.89769036	Opossum Creek - Background
SW14	39.71267193	-80.88356048	Opossum Creek
SW15	39.72036843	-80.87966859	Opossum Creek - Background
SW16	39.70961481	-80.8259064	Ohio River
SW17	39.70291255	-80.90657651	Unnamed Tributary to Opossum Creek
SW18	39.71019256	-80.90308964	Unnamed Tributary to Opossum Creek
SW19	39.69405422	-80.90380043	Unnamed Tributary to Opossum Creek - Background
SW20	39.71400000	-80.89700000	Opossum Creek
SW21	39.69430920	-80.9036255	Unnamed Tributary to Opossum Creek
SW22	39.77134069	-80.8673948	Ohio River - Background
SW23	39.69411087	-80.90385437	Unnamed Tributary to Opossum Creek - Background
SW25	39.69654332	-80.90476602	Unnamed Tributary to Opossum Creek

All locations that were included in the 15.a.ii evaluation are identified on **Figure 1 in Appendix A**.

2.0 SURFACE WATER AND SEDIMENT EVALUATION

Daily surface water sampling and periodic sediment sampling based on rain events was initially performed according to the SAP. Fourteen Safety Data Sheets (SDSs) for products present on the Eisenbarth Well Pad on June 28, 2014 were used to develop a sampling protocol. Unified Command identified target criteria for analytes that would continue to be sampled through implementation of the WSSSAAP as discussed in Section 1.1, above.

Ecological screening levels were utilized in the evaluation of the constituents identified in the SAP Version 1.7 and the subsequent WSSSAAP. According to the OEPA Ecological Risk Assessment Guidance, "*If all concentrations of the site-related ecological stressors are below the appropriate screening concentrations, in all relevant media, and surface waters are meeting applicable criteria, then the entire site is considered to have minimal impact on important ecological resources and no further ecological assessment is necessary.*" See Ohio EPA, Division of Environmental Response and Revitalization, Ecological Risk Assessment Guidance Document, revised April 2008, at page 3-1, available at <http://www.epa.ohio.gov/portals/30/rules/RR-031.pdf>. However, it is important to note that when a constituent exceeds an ecological screening level, that is not necessarily indicative of potential adverse effects to aquatic life, wildlife, or human health. Instead, an exceedance of a screening level only means that further evaluation of the analyte may be necessary. For example, aluminum and iron levels in the Hannibal, OH region exceed their respective screening levels; however, these levels are normal for the region as noted by the OEPA Division of Environmental Response and Revitalization (DERR) Ecological Risk Assessment Guidance.

When possible, surface water constituents were compared to the chemical criteria supplied by the OEPA pursuant to OAC 3745-1. Further, OEPA regulation states, "*If all chemical constituents are below their corresponding chemical criteria, then the surface water may be eliminated as an exposure medium.*" See OAC 3745-300-08(G)(2)(a). Screening values are intended to protect aquatic life and terrestrial life from long-term exposures, as well as being protective of people against adverse exposure via fish consumption. Therefore, these toxicity constants are conservative (i.e. health protective) in nature and by design are likely to overestimate the hazard posed by a given exposure to a chemical.

Based on the criteria discussed above, acetone and chloride were identified as the two analytes that met the target criteria (i.e. detection in over 10% of samples, exceedance of ecological screening values, and consistent trending for surface waters). In addition, two more target analytes were identified: Tributyltetradecylphosphonium chloride (TTPC) (despite the lack of a regulatory TTPC standard for comparison) and total petroleum hydrocarbons (TPH). A monthly average summary graph is provided for each (acetone, chlorides, TPH, TTPC) in **APPENDIX A**.

A majority of the analytes tested under the SAP were eliminated under the WSSSAAP.

The presence of constituents that were contained in materials stored on the Eisenbarth Well Pad was relevant to the initial monitoring activities following the incident. However, several such constituents were also found to naturally exceed screening levels in background samples, including aluminum, iron, copper, bis (2- ethylhexyl) phthalate, beryllium, and lead. Sampling for these constituents under the SAP continued only until the implementation of the WSSSAAP on July 18, 2014. The WSSSAAP eliminated

these and other analytes from the previous plan that either had not exceeded screening levels during SAP monitoring, were not detected in greater than 10% of samples, or naturally exceeded screening levels.

Gulf Coast Analytical Laboratories, LLC, (GCAL) developed a High-Pressure Liquid Chromatography with UV Detector (HPLC-UV) analytical method to screen for TTPC in water and sediment samples. However, due to the absence of an accepted method for analyzing TTPC in water during the initial stage of the response while this methodology was being developed, the additional sample volumes that would have been required were not collected at several locations sampled before July 4, 2014. Once arrangements for the development of the HPLC-UV TTPC method were established, the additional sample volume determined to be necessary was then collected for the appropriate analysis. Several monitoring stations sampled prior to July 4, 2014 therefore do not have TTPC results.

The US EPA later required Statoil to use a Liquid chromatography-tandem mass spectrometry (LC/MS/MS) method for TTPC detection. The LC/MS/MS method has been utilized for all sampling and analysis after October 27, 2014 and is the method represented on summary graphs. The HPLC-UV method was used additionally for result confirmation and data quality verification as needed. Data generated from the HPLC-UV method is provided in Appendix F (submitted on CD). An explanation of the variability of these two methods is available in Section 3.0.

TTPC was detected sporadically in all media used for background samples, including upstream, background tributaries (**Table 3**). One possible explanation for the presence of TTPC in background locations is due to the potential use of TTPC as an anti-algae compound in re-circulatory water systems in the local area. TTPC was detected in background soil sampling locations in borings SB-1, SB-2, and SB-3 of the ODNR work program (please refer to report 15.a.i, page 29). These background detections in all three types of media tested indicates either the presence of TTPC in the area at detectable levels from sources outside of the Eisenbarth Well Pad incident, or the unreliability of the prescribed testing methodology utilized for TTPC analysis, or both. The background location sample detections are summarized below:

Table 3
Background Samples with Detections of TTPC

Sample Date	Location ID	Media	Relation to Eisenbarth Well Pad Location	TTPC Result	Units
July 6, 2014	SW23	Surface Water	Tributary Upstream of Pad Drainage (South)	20.7	µg/L
July 15, 2014	SW15	Surface Water	Unassociated Tributary to North	9.16	µg/L
July 15, 2014	SW15 (DUP)	Surface Water Duplicate	Unassociated Tributary to North	2.44	µg/L
August 13, 2014	SE23	Sediment	Tributary Upstream of Pad Drainage (South)	18.3	µg/kg
July 21, 2014	SE11	Sediment	Unassociated Tributary to East	219,000	µg /kg
August 13, 2014	SE23	Sediment	Tributary Upstream of Pad Drainage (South)	2.58	µg /kg
Nov. 24, 2014	SB01	Soil	Background soil boring 0-2'	39.7	µg /kg

Nov. 24, 2014	SB02	Soil	Background soil boring 0-2'	0.286	$\mu\text{g}/\text{kg}$
Nov. 24, 2014	SB03	Soil	Background soil boring 0-2'	0.812	$\mu\text{g}/\text{kg}$

Currently there is no single regulatory agency or program that regulates the cleanup of, or establishes potable water quality standards for, acetone, chlorides, TPH, and TTPC. As such, a patchwork of regulatory guidance documents from various agencies and programs (federal and regional) were evaluated for use during the SAP monitoring program. The screening levels were proposed to, and accepted by, the Unified Command for purposes of the SAP and WSSSAAP monitoring. The rationale for selection of the screening levels is restated herein.

Although there were no known sources of acetone on the well pad during the June 2014 fire, there were detections of acetone in water quality samples. Isopropanol (isopropyl alcohol) is a component of GasPerm 1000, which had been on location at the time of the well pad fire. Isopropyl alcohol can potentially be oxidized to acetone through combustion. Acetone, therefore, was requested by the US EPA to be added as a parameter for analysis and evaluation. While the US EPA does not have surface water screening levels for acetone, the US EPA Region V Resource Conservation and Recovery Act (RCRA) program has identified a surface water screening level of 1,700 $\mu\text{g}/\text{L}$ for acetone, which can be found in the US EPA Region V RCRA Ecological Screening Levels (August, 2003). This level was used as a screening level for acetone in surface water and a corresponding screening level of 9.9 $\mu\text{g}/\text{kg}$ for sediments.

Chlorides are a necessary component of both fresh and salt water receptors. The US EPA aquatic life criterion of 230 mg/L for chronic, continuous concentrations in freshwater was utilized as the screening level for water quality samples analyzed for chlorides. This aligns with the federal secondary drinking water standard of 250 mg/L. No screening levels are available from federal or regional state agencies for chlorides in soils or sediments. Chloride concentrations in sediments were analyzed as a leachate (mg/L) using US EPA method SM4500.

No action levels exist for acetone and chlorides because there are no guidelines for these in surface water, sediment, or soil. Standard ecological risk assessment protocol dictates that when a screening level is exceeded in a laboratory analysis, action should then be taken to assess the potential risk and whether any remediation is needed and at what concentration of the constituent (risk assessment, increased sampling, etc.) action should be taken. While some samples exceeded chloride or acetone screening levels in the days immediately following the event, they quickly decreased to and remained below these levels, indicating that no further action or establishment of action levels was necessary.

TPH guidelines vary by state and agency. The only applicable guidelines regarding TPH found for Ohio is the OEPA *Petroleum Contaminated Sites Guidance Document for Emergency Response Actions*. These guidelines do not provide surface water screening or action levels for TPH, but provide a soil action level ranging from 380 parts per million (ppm) (380 mg/kg) to 1,156 ppm (1,156 mg/kg) depending on variables such as proximity to wells, water intakes, groundwater, and soil type. A conservative screening level of 380 mg/kg was established for the sediment analysis.

A 1 part per billion (ppb) (1 $\mu\text{g}/\text{L}$) screening level was established for TTPC in water based upon the US EPA EcoSAR analysis of test data on analogous cationic surfactants. The US EPA EcoSAR analysis

estimated that adverse effects may occur to aquatic organisms if concentrations of TTPC were to exceed 11 ppb ($\mu\text{g/L}$) in surface waters. The screening level was established by applying an uncertainty factor of 10 to arrive at the 1 ppb screening level. This presents a level protective of aquatic life that is not anticipated to cause any adverse effects to biota. Using the US EPA guidelines for sediment partitioning (“Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms”) that takes into account the TTPC binding affinity for soil and what level in sediment would potentially cause 1 ppb in surface waters, a sediment screening level of 859,000 $\mu\text{g/kg}$ was established.

TTPC is a common oil and gas biocide control agent, and is also approved for use in the papermaking industry, in cooling water systems, industrial cleaning water and other industrial water systems. Industries in the county, which include steel and aluminum plants (including aluminum smelting), other oil and gas operations (such as the Williams Pad), coal mining, and stone quarries, could be considered as potential sources. All of these industries use water in their daily operations, and likely use re-circulatory systems that require algae and bacteria control. Detections of TTPC in upstream locations that were not associated with the Eisenbath Well Pad incident and in the soil uphill of the Eisenbath Well Pad but downhill of the Williams pad strongly indicates that TTPC is used by other facilities/operations in the area.

For the purposes of comparison and reporting, the phrase “non-detect” is used herein to identify any analyte that was not detected at or above the applicable reporting limit (RL) or method detection limit (MDL). A Reporting Limit (RL or RDL) is the limit of detection for a specific target analyte for a specific sample after any adjustments have been made for dilutions or percent moisture. Some state regulatory programs require a laboratory to prove it can reliably “see” down to its RL by setting the RL at the lowest point on the calibration curve. In contrast, the Method Detection Limit (or MDL) is lower than the RL (often much lower) and is a statistical calculation. The term “Detected” in this context means that a sample that contains the analyte detected at the MDL can be distinguished from a blank with reliable certainty. The MDL is a laboratory-specific number, dependent (among other things) on the instrumentation used by a particular laboratory. Since the MDL is below the point of calibration, results reported down to the MDL are not reliable and must be qualified as estimated values and, as such, carry a “J” qualifier designation. Analyses with a qualifier indicating that the result is estimated due to it being detected between the MDL and the lowest quantifiable limit are herein considered to be viable in presence, but not in precise concentration and are noted on laboratory reports and tables.

2.1 Pad and Impoundment

One sampling location (PW05) was established for a single sampling event on June 29, 2014 (**Table 4**), to evaluate possible migration of SAP constituents to the Eisenbath Well Pad impoundment, which is located down-gradient and to the west of the Eisenbath Well Pad (See Figure 2 in **APPENDIX B**).

TTPC was not tested for at the PW05 impoundment location, as an analysis method was not yet established at the time of sample collection. Acetone and TPH were tested for and both were non-detect. Chlorides were detected in PW05 at 144 mg/L, which is below the associated surface water screening level of 230 mg/L. Water quality results are included in **APPENDIX F** (submitted on CD).

Table 4
Impoundment
Location Summary (Reference Figure 2)

Location ID	Latitude	Longitude	Receptor
PW05	39.69700241	-80.90020752	Pond/Impoundment Water

2.2 Unnamed Tributary to Opossum Creek

Surface run-off (generated by fire-fighting activities) was monitored beginning on June 28, 2014 as the primary migration pathway of concern upon initial assessment of the Eisenbarth Well Pad. While berms were being built on the Eisenbarth Well Pad site to contain fire-fighting water, surface flow was visible from the well pad. Sampling and monitoring locations associated with and evaluated in the context of the unnamed tributary to Opossum Creek are SW06, SW17, SW17U, SW17D, SW18, SW19, SW21, SW23, and SW25, as referenced in **Table 5**.

Figures and data trends for these locations are presented in **APPENDIX C**; all water quality and sediment laboratory reports are included in **APPENDIX F** (submitted on CD).

Table 5
Unnamed Tributary to Opossum Creek
Location Summary (Reference Figure 3 in Appendix C)

Location ID	Latitude	Longitude	Receptor
SW06	39.69456482	-80.90405273	Unnamed Tributary to Opossum Creek
SW17	39.70291255	-80.90657651	Unnamed Tributary to Opossum Creek
SW17U	39.70233154	-80.90707397	Unnamed Tributary to Opossum Creek – 100 feet Upstream of SW17
SW17D	39.90302963	-80.90679169	Unnamed Tributary to Opossum Creek – 100 feet Downstream of SW17
SW18	39.71019256	-80.90308964	Unnamed Tributary to Opossum Creek
SW19	39.69405422	-80.90380043	Unnamed Tributary to Opossum Creek - Background
SW21	39.6943092	-80.9036255	Unnamed Tributary to Opossum Creek
SW23	39.69411087	-80.90385437	Unnamed Tributary to Opossum Creek - Background
SW25	39.69654332	-80.90476602	Unnamed Tributary to Opossum Creek

While acetone concentrations at locations in the unnamed tributary to Opossum Creek exceeded the 1,700 µg/L ecological screening value in the days immediately following the incident, acetone has not been detected in surface water since July 9, 2014.

Acetone has been detected intermittently, and occasionally above the 9.9 µg/kg sediment screening level, at all six of the monitoring locations in the unnamed tributary to Opossum Creek, but detection levels are showing a general decline and most recent data is non-detect. Given the lack of acetone in any product at

the Eisenbarth Well Pad at the time of the incident, the lack of corresponding acetone detections in surface water, and acetone's natural tendency to volatilize, these sediment detections may be due in part to laboratory contamination. Acetone is a common laboratory cleaning chemical and therefore is recognized as a frequent sample contaminant. Since acetone has not been detected in any of the unnamed tributary surface water samples since July 9, 2014, and was non-detect in recent sediment samples, no further assessment of acetone in the unnamed tributary to Opossum Creek is necessary.

Chlorides have not been detected above the established 230 mg/L screening level in surface water of the unnamed tributary to Opossum Creek since the day after the incident, June 29, 2014, when a detection of 296 mg/L was reported for the SW06 monitoring location. No other monitoring point in the unnamed tributary to Opossum Creek had an exceedance of chlorides in surface water at any time, and SW06 chloride levels dropped and remained low just days after the incident.

There was one (1) chloride detection in the sediment of the unnamed tributary to Opossum Creek during monitoring at SW17, on July 2, 2014 (5.9 mg/L). Chlorides were non-detect in sediment for the remainder of sampling events at all sampling locations in the unnamed tributary to Opossum Creek. Since chlorides have not been detected above the applicable screening level for surface water since June 29, 2014, and have not been detected in sediment since July 2, 2014, no further assessment of chlorides in the unnamed tributary to Opossum Creek is necessary.

There was no established surface water screening level for TPH for purposes of the WSSAAP. Detections of TPH in surface water of the unnamed tributary to Opossum Creek had a peak concentration of 2.5 mg/L at the SW06 location on June 29, 2014. TPH detections declined through July 13, 2014. Then between July 14, 2014 and December 1, 2014, TPH was either non-detect in surface water or concentrations were orders of magnitude lower than previous concentrations, with the maximum detection during this period being at the SW21 location on July 18, 2014 (0.26 mg/L). Sampling location SW17D has not had any detectable levels of TPH. Additionally, after December 1, 2014, all locations were non-detect for TPH in surface water through the conclusion of monitoring.

TPH detections in the sediments of the unnamed tributary to Opossum Creek were in exceedance of the 380 mg/kg screening level only once during monitoring, at the SW17 location on July 2, 2014 (884 mg/kg). No other sediment sampling location had any detections of TPH over screening levels. The range and frequency of TPH detections after September 3, 2014 are comparable in concentration to the background detections in the unnamed tributary to Opossum Creek at location SW23, which had a TPH detection of 9.5 mg/kg on August 13, 2014. Since TPH has not been detected in surface water since December 1, 2014, and has not exceeded the sediment screening level in over a year, no further assessment of TPH in the unnamed tributary to Opossum Creek is necessary.

TTPC levels have fluctuated in the surface water and sediment of the unnamed tributary to Opossum Creek, most notably at locations SW21, SW17, and SW06. SW21 and SW06 are located in close proximity to the Eisenbarth Well Pad, closer than the majority of the other monitoring points. These two are the only locations out of the entire monitoring program that have had any detection at or above the 1 µg/L screening level established for surface water; SW17 has the only TTPC exceedance of the 859,000 µg/L sediment screening level. This variation appears to be partially due to winter temperature fluctuations and the freezing and thawing cycle likely releasing some bound TTPC from the sediments into the surface water. Based on sampling data from April 2015, there were no exceedances of the 1 µg/L screening level for surface water at SW06. However, there were exceedances of the surface water

screening level in April at SW21. There have been no exceedances of the sediment screening level since July 2014. Additionally, when surface water samples had TTPC detections at 2 µg/L or greater the laboratory would automatically rerun those samples in order to validate these detections, due to ongoing variation in results from duplicate samples. Based on these criteria, SW21 was the only surface water location to require re-runs of the TTPC analysis, and this data is included in the associated graph (**APPENDIX C**). In many cases, the second run was significantly lower than the first analysis. A number of re-runs varied from their original run by orders of magnitude such that it put the results for one run above the 1 µg/L screening level and one below. The February 15, 2015 surface water quality sample, for example, was 8.9 µg/L on one run and was 0.538 µg/L on the additional run conducted on the same sample.

It is also important to note that there were no observed impacts to aquatic life or vegetation during sampling, and the TTPC spikes occurred during (and following) the coldest months of the year. TTPC has decreased in both surface water and sediments over time. Statoil expects that the three additional sampling events that will be conducted of surface water and sediments as outlined in the Work Plan should provide more insight as to TTPC fluctuations and proper laboratory methodology. Further, the WST and WET testing that will be conducted in 2015 and 2016 pursuant to Paragraph 15.a.iii of the AOC and the Work Plan will assess potential effects from TTPC at varying concentrations. Following the results of the toxicity testing, as needed, screening levels may be reexamined to ensure they are both protective of the environment and representative of the potential impacts. As of April 8, 2015, TTPC was only present above the screening level for surface water at one monitoring location. Further, there have been no exceedances of the sediment screening level since July 2014. The three additional rounds of surface water and sediment sampling required by the Work Plan, and the WST and WET testing to be conducted in 2015 and 2016, will inform a determination as to whether further assessment of TTPC in the unnamed tributary to Opossum Creek is necessary.

2.3 Opossum Creek

There are seven (7) sampling locations associated with Opossum Creek, four (4) associated with the downstream areas (SW04, SW08, SW14, SW20,) and three (3) background locations (SW11, SW12, SW15) referenced in **Table 6**. Data trends and figures for these locations are presented in **APPENDIX D**; all water quality and sediment laboratory reports are included in **APPENDIX F** (submitted on CD). Opossum Creek flows from west to east, discharging into the Ohio River, and is located to the north of the Eisenbarth Well Pad.

Table 6
Opossum Creek
Location Summary (Reference Figure 4)

Location ID	Latitude	Longitude	Receptor
SW04	39.71111618	-80.88783056	Opossum Creek
SW08	39.73865509	-80.85214996	Opossum Creek
SW11	39.71075302	-80.88822216	Opossum Creek – Background
SW12	39.71466093	-80.89769036	Opossum Creek – Background
SW14	39.71267193	-80.88356048	Opossum Creek
SW15	39.72036843	-80.87966859	Opossum Creek – Background
SW20	39.714	-80.897	Opossum Creek

Acetone has in general, been non-detect in surface water for the duration of Opossum Creek monitoring. Acetone exceeded the 1,700 µg/L ecological screening value at SW04 on June 30, 2014, but then receded to below screening values. Acetone has been non-detect in surface water since July 5, 2014 with the exception of only two low-level detections on July 14, 2014, and October 17, 2014.

Acetone has been detected intermittently at all four of the sediment monitoring locations as well as at one background sediment location. However, given the lack of acetone in any product at the Eisenbarth Well Pad at the time of the incident, the lack of corresponding acetone in surface water, and acetone's natural tendency to volatilize, these detections are potentially due in part to laboratory contamination. This theory is strengthened by the 2,490 µg/kg acetone detection in a background sediment sample collected on July 21, 2014 at the SW11 location, which was over the 9.9 µg/kg screening level and higher than any of the acetone detections at other sampling locations. All of the acetone detections in the sediment samples collected from Opossum Creek are lower than the acetone detection in the sample collected at the background location, though some of these detections have been above the sediment screening level. Since acetone has not been detected in surface water since October 17, 2014, and has been well below the level detected in a background sediment sample obtained from an upstream sampling location not associated with the Eisenbarth Well Pad incident, no further assessment of acetone in Opossum Creek is necessary.

Chloride levels in Opossum Creek surface water have been below the established 230 mg/L screening level since monitoring began. Chlorides were largely absent from sediments of Opossum Creek with the exception of three (3) detections at the SW08 location on March 12, 2015 (8.9 mg/L), March 16, 2015 (6.5 mg/L), and April 4, 2015 (12.0 mg/L). SW08 is located at the mouth of Opossum Creek, at its confluence with the Ohio River. As such, some degree of influence from backflow and mixing from the Ohio River is to be expected. Since chlorides have not been detected above the screening level for surface water and have not been detected in sediment samples from monitoring locations that are not influenced by the Ohio River, no further assessment of chlorides in Opossum Creek is necessary.

TPH was detected in a few surface waters samples of Opossum Creek only six (6) times during monitoring, and has not been detected in surface water at any locations in Opossum Creek since November 30, 2014. TPH was not detected above the established 380 mg/kg screening level in an Opossum Creek sediment monitoring location with the exception of a background location; background location SW11 had a TPH detection in sediment of 1,150 mg/kg on July 21, 2014. Since TPH has not been detected in surface water samples since November 30, 2014, and has not been detected above the screening level for sediment (except at a background location), no further assessment of TPH in Opossum Creek is necessary.

TTPC was detected in surface water of Opossum Creek only seven (7) times during monitoring. These detections were sporadic and never exceeded the site-specific 1 µg/L screening level in any Opossum Creek surface water monitoring location.

TTPC was detected in the sediment of Opossum Creek consistently, including at background sampling location SW11, but no detections exceeded the site-specific screening level of 859,000 µg/L. Sediment detections of TTPC have shown a decreasing trend over time. The background sample collected on July 21, 2014 was the highest TTPC detection in the sediment of Opossum Creek. The downward trend

supports that natural attenuation of TTPC from sediments is occurring. Since TTPC has not been detected above the screening levels for surface water or sediment, no further assessment of TTPC in Opossum Creek is necessary.

2.4 Ohio River

Statoil has collected surface water and sediment samples from five (5) locations on the Ohio River. Two (2) of the sample locations (SW07 and SW22) were upstream of the confluence with Opossum Creek (background samples) and three (3) locations were downstream of the confluence (SW09, SW10, SW16) prior to the first public water intake, and referenced in **Table 7**. Data trends and figures for these locations are presented in **APPENDIX E**; all water quality and sediment laboratory reports are included as **APPENDIX F** (submitted on CD) including TTPC data using the HPLC-UV method.

Table 7
Ohio River
Location Summary (Reference Figure 5)

Location ID	Latitude	Longitude	Receptor
SW07	39.762909	-80.870556	Ohio River – Background
SW09	39.72792053	-80.84043884	Ohio River
SW10	39.66869354	-80.86100769	Ohio River
SW16	39.70961481	-80.8259064	Ohio River
SW22	39.77134069	-80.8673948	Ohio River – Background

These locations were sampled during the initial SAP monitoring phase, with the last of the Ohio River samples being collected on July 18, 2014. As demonstrated by the data discussed below and in **APPENDIX E**, the Ohio River was not influenced by the Eisenbarth Well Pad incident. Accordingly, no further assessment of any of the four SAP constituents in the Ohio River is necessary.

Acetone has been non-detect in the surface water and sediment samples collected for the duration of Ohio River monitoring.

Chlorides were non-detect in all of the sediment samples collected from the monitoring stations on the Ohio River. In surface water samples, chloride detections ranged from 19.4 mg/L to 35.60 mg/L with little to no fluctuations, indicating a steady state level of chlorides that is normal for the area. The screening level for chlorides in surface water is 230 mg/L.

TPH detections in sediment at the background sample locations upstream from the Opossum Creek confluence and those downstream of the confluence to the first public water intake were similar to one another in concentration and relative frequency. At one of the two background locations (SW22), TPH was detected in sediment at 37.10 mg/kg on July 2, 2014 (sediment screening level is 380 mg/kg). TPH detections at downstream sediment sampling locations were 22.10 mg/kg and 85.50 mg/kg at SW16 (July 2 and July 10, 2014, respectively), 38.20 mg/kg at the SW09 location on July 2, 2014, and 33.9 mg/kg at the SW10 location on July 2, 2014. Neither the upstream background nor the downstream locations exceeded screening levels at any time during Ohio River monitoring. TPH was not detected in the surface water sampling on the Ohio River.

TTPC was only tested for in the Ohio River using the original HPLC-UV method. Sediment samples were non-detect for this method in the Ohio River. No Ohio River samples were run under the LC/MS/MS analytical method for TTPC.

2.5 Summary Trends

Data for all of the sampling locations in the areas of investigation was condensed into monthly average, time-lapsed trend comparison graphs. These trend graphs provide a side-by-side analysis of the monthly average detections in the unnamed tributary to Opossum Creek, Opossum Creek, and the Ohio River. A monthly average summary graph is provided for acetone, chlorides, TPH, and TTPC for surface water and sediment in **APPENDIX A**.

The trend graphs show a pattern of early average detections being highest in the unnamed tributary to Opossum Creek. Average detections decrease as distance from the Eisenbarth Well Pad increases, with the monitored sections of the Ohio River showing no influence from the Eisenbarth Well Pad incident that occurred on June 28, 2014. Additionally, all areas of investigation show that acetone, chlorides, TPH, and TTPC declined over time. Acetone, chlorides, and TPH all appear to be attenuated; TTPC was continuing to observably attenuate at the conclusion of this portion of the surface water and sediment monitoring. TTPC also appears to be present in background locations. Surface water also more rapidly recovered to background levels than sediments in the area closest to the Eisenbarth Well Pad – the unnamed tributary to Opossum Creek. As monitoring continues, these downward trends are expected to remain consistent.

3.0 QUALITY ASSURANCE/QUALITY CONTROL

Sampling was carried out in conjunction with quality assurance (QA) goals to confirm generation of valid and defensible data. For approximately every ten (10) samples collected in the field, one (1) field duplicate was collected and submitted for laboratory analysis to verify the reproducibility of the sampling and analytical methods. Laboratory quality assurance/quality control (QA/QC) procedures were consistent with the prescribed analytical methods and relevant state and federal regulatory guidance. Internal laboratory quality control procedures included method blanks, matrix spikes/matrix spike duplicates, surrogate samples, calibration standards, and laboratory control standards, all of which are documented in the lab specific Standard Operating Procedures (SOPs) and in the laboratory reports for the respective samples, when applicable.

Currently, no fully-validated US EPA analytical method exists for the analysis of TTPC. With no available fully-validated method, GCAL developed an HPLC-UV analytical method to screen for TTPC in water, soil, and sediment samples. This method was developed internally at GCAL with guidance from Agilent and BWA Water Additives SOP titled BWA-HPLC-008. The analysis was conducted on an Agilent HPLC 1200 with UV detector in indirect UV mode. The GCAL-developed TTPC method and a subset of results were reviewed and validated by a third party data validator. The laboratory generated a MDL of 0.8 - 1.7 µg/L for TTPC in water and 103 µg/kg for soils. A limitation with this HPLC-UV based method is that it cannot differentiate between multiple analytes that take the same amount of time to travel through the instrument column. This could result in two or more analytes that co-elute, resulting in potential false positives.

The US EPA concurrently developed a method to screen for TTPC in water, soil, and sediment. Statoil requested that GCAL develop a second TTPC method following the US EPA's methodology. This second method, which was employed in October 2014, uses a different extraction procedure and LC/MS/MS analysis using an Agilent HPLC 1290 with a 6460 Triple Quad LC/MS system. This method breaks each molecule into ionized fragments and identifies these fragments using their mass to charge ratio, ultimately increasing the certainty that the analyte of interest is accurately identified. The laboratory generated an MDL of 14.3 ng/L and Limit of Quantitation (LOQ) of 100 nanogram per liter (ng/L) for TTPC in waters and 34.5 nanogram per kilogram (ng/kg) and Practical Quantitation Limit (PQL) of 250 ng/kg for soils/sediment matrices. All reporting limits were well below the 1 ppb (1 µg/L) TTPC screening level. Again, the method and data were reviewed and validated by a third party data validator.

TTPC results have shown variation with the US EPA method, which is attributed to the physiochemical properties of TTPC. A laboratory audit of GCAL was performed by CTEH in April 2015, to validate the current methodology and sample extraction. Based upon lab audit results, additional studies were performed to determine the sources of variable results. CTEH has concluded that the variation in results cannot be entirely attributed to instrumentation, and opines that future samples should be prepared using semi-volatile sample preparation techniques, similar to US EPA 8270 methodology. The US EPA-derived method treats TTPC as a volatile compound out of an abundance of caution. Ongoing laboratory auditing indicates that TTPC is more semi-volatile in nature and may not be evenly distributed in aquatic samples during analysis.

TTPC has been detected in surface water and sediment background locations that were not associated with the Eisenbarth Well Pad incident. TTPC was also detected in background soil sampling locations in borings SB-1, SB-2, and SB-3 of the ODNR work program. These background detections in all three media tested indicate the presence of TTPC which is unrelated to the Eisenbarth Well Pad incident. As discussed above, due to the potential use of TTPC as an anti-algae compound in re-circulatory water systems, it is extremely likely that TTPC has been used in the local area.

In addition to TTPC in background samples, multiple locations have shown inconsistent detections of TTPC in surface water and sediment. Additional analysis of the same sample showed these samples to be non-detect. Unreliability of the results may be attributed to the prescribed testing methodology utilized for TTPC analysis. Additionally, the composition of the collected sampling media is expected to have a direct impact on the laboratory results, as a clay-based sediment sample will be more laden with soil-binding TTPC than a more sand or rock based quality sample, and a turbid water quality sample will be expected to have a similar impact on results. A low energy area of the stream such as the inner arch or pool of a meander will have less flushing capacity than an area of higher velocity such as riffles or narrow segments. Therefore, as TTPC sample composition changes from site to site and from day to day due to natural variation, likewise the concentrations of TTPC as they relate to that media would show fluctuation.

Acetone is a common laboratory contaminant that was not present on-site. While the US EPA generally considers acetone to be a laboratory contaminant, detections greater than 10 times the amount found in representative sample blanks should be included and considered as a true detection in samples. Acetone is commonly used in preparation of environmental samples for extraction and dilution and can be present in low levels in samples.

4.0 CONCLUSIONS

The objective of this report was to evaluate data generated from monitoring, sampling, and assessment activities for sediment and surface water samples collected from an unnamed tributary to Opossum Creek, Opossum Creek, and the Ohio River from the confluence with Opossum Creek to the first downstream public water intake. Four SAP constituents monitored during the WSSSAAP were evaluated in this report: acetone, chlorides, TPH, and TTPC.

Impoundment:

TTPC was not analyzed at the PW05 impoundment location, as an analysis method was not established at the time of sample collection. However, acetone and TPH were both non-detect. Chlorides were detected in PW05 but below the associated screening level. Accordingly, this data indicates that SAP constituents are not present in the impoundment and no further assessment of the four SAP constituents is necessary for the impoundment.

Unnamed Tributary to Opossum Creek:

The unnamed tributary to Opossum Creek had initial detections of SAP constituents in both surface water and sediments following the Eisenbarth Well Pad incident; detections above screening levels for the majority of the SAP constituents in surface water and sediment have ceased, and detections of TTPC in surface water is continuing on a downward trend that is expected to continue through the remainder of the monitoring program. Acetone has not been detected in surface water of the unnamed tributary since July 9, 2014. Chlorides have not been detected above established screening levels in surface water of the unnamed tributary since June 29, 2014. After December 1, 2014, all unnamed tributary locations were non-detect for TPH in surface water. TPH detections in the sediments of the unnamed tributary were in exceedance of the screening level only once, and the range and frequency of TPH detections after September 3, 2014 are comparable in concentration to the unnamed tributary's background location. Two locations on the unnamed tributary have had TTPC detection at or above the surface water screening level. This appears to be partially due to winter temperature and seasonal fluctuations and the freezing and thawing cycle likely releasing some bound TTPC from the sediments into the surface water. There have been no exceedances of the sediment screening level in the unnamed tributary since July 2014. Accordingly, the data indicates that acetone, chlorides, and TPH are not present in the unnamed tributary to Opossum Creek at levels at or above the established screening levels and no further assessment of these SAP constituents in the unnamed tributary to Opossum Creek is necessary. The additional testing that will be conducted as outlined in the Work Plan and further discussed in Section 2.2, above, will provide additional information to inform decisions regarding any further assessment of TTPC in the unnamed tributary to Opossum Creek.

Opossum Creek:

While in the days immediately after the fire, there were detections of some SAP constituents in surface water of Opossum Creek, no sedimentary impacts have been detected. Acetone in general has been non-detect in surface water for the duration of Opossum Creek monitoring and has been detected intermittently at all four of the sediment monitoring locations. However, given the lack of acetone in any product at the Eisenbarth Well Pad at the time of the incident, the lack of corresponding acetone in surface water, and the compound's natural tendency to volatilize, these detections are likely due to laboratory contamination. Chloride levels in Opossum Creek surface water have consistently been below established screening levels since monitoring began and were largely absent from sediments of Opossum

Creek with the exception of three (3) detections. TPH has not been detected in surface water at any locations on Opossum Creek since November 30, 2014. TPH was never detected above the established screening levels in an Opossum Creek sediment monitoring location with the exception of the background location. Surface water TTPC detections were sporadic and never exceeded the 1 µg/L screening level. TTPC was detected in the sediment of Opossum Creek, including at a background sampling location, but no detections exceeded the site-specific screening level. Accordingly, the data indicates that SAP constituents are not present in Opossum Creek at levels at or above the established screening levels and no further assessment of the four SAP constituents in Opossum Creek is necessary.

Ohio River:

There have been no detections in the Ohio River surface water or sediment samples associated with the Eisenbarth Well Pad incident. Acetone has not been detected in surface water or sediments during Ohio River monitoring. Chlorides were non-detect in all of the sediment samples and were at a level that is normal in surface water for the area. TPH detections in sediment at the sample locations upstream from the Opossum Creek confluence and those downstream of the confluence were similar in concentration. Sediment samples collected from the Ohio River were non-detect for TTPC using the HPLC-UV method. Accordingly, the data indicates that SAP constituents are not present in the Ohio River at levels at or above the established screening levels and no further assessment of the four SAP constituents in the Ohio River is necessary.

As surface water and sediment monitoring continues through 2015 on the unnamed tributary to Opossum Creek and on Opossum Creek, it is expected that residual detections of some SAP constituents will continue to demonstrate the current declining trends. Statoil will submit one additional report regarding data generated pursuant to Paragraph 15.a.ii pursuant to the timeline established by the Work Plan. Aquatic and sedimentary life within the waterways will also be evaluated during the continued monitoring in 2015 and 2016, with two (2) biological assessments, two (2) whole effluent toxicity tests, and two (2) whole sediment toxicity tests performed approximately 12 months apart.

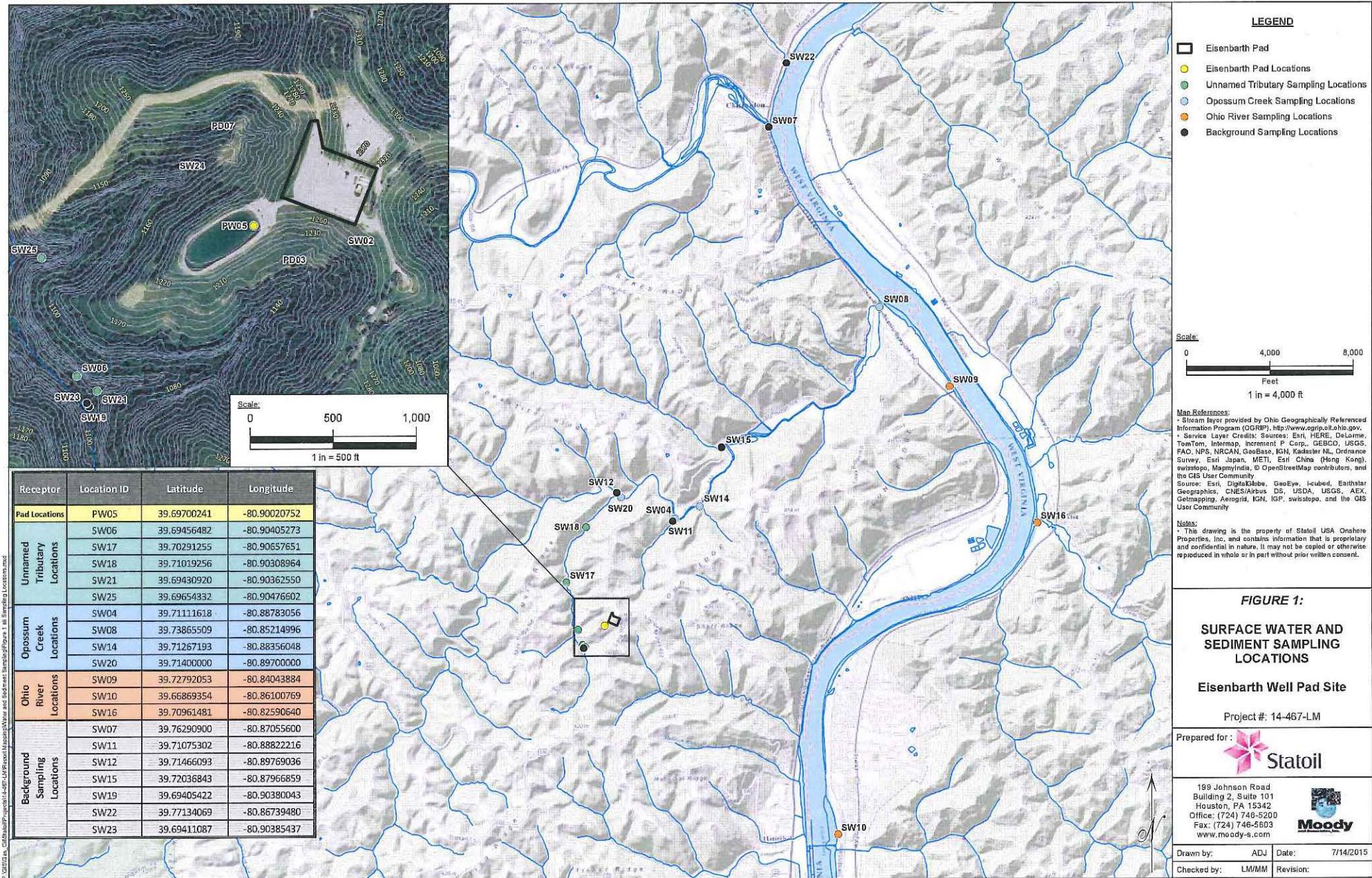
APPENDIX A

Master Summary

APPENDIX A.1

Figure 1

Master Location Summary Map

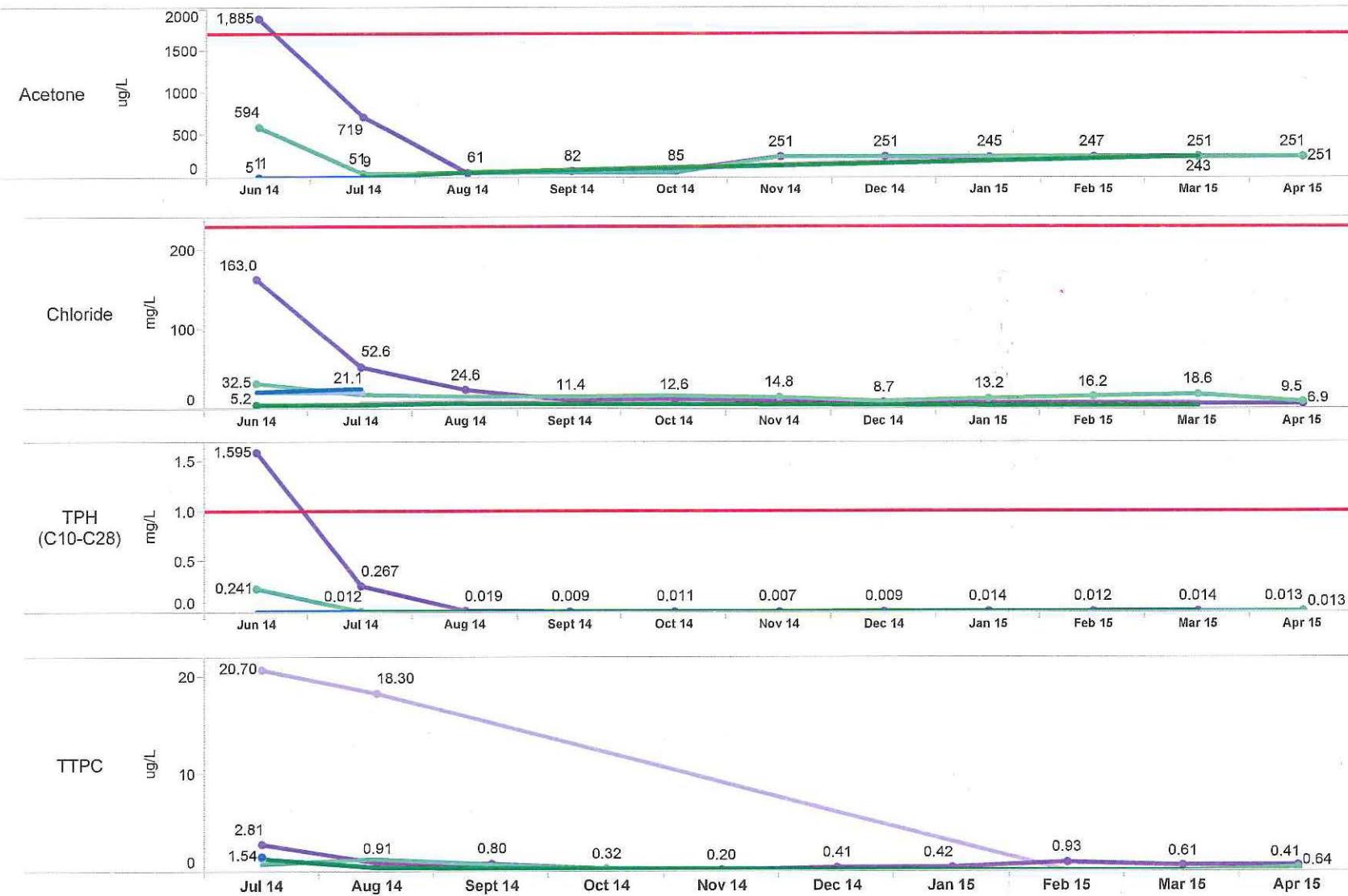


APPENDIX A.2

Master Trend Graphs

Surface Water

Surface Water Monthly Averages



Note: 100% of data has undergone Level II validation, and 10% of data has undergone Level IV validation by a third party data validator.
ND = not detected in sample(s) analyzed were considered at half the detection limit of the method detection limit (MDL) established by Pace Laboratories in monthly average calculations.

Chloride EPA Freshwater CCC (chronic) = 230 mg/L .
Acetone EPA Region 5 RCRA Screening = 1,700 $\mu\text{g/L}$.
TTPC EPA Suggested Screening Level=1 $\mu\text{g/L}$.

Location Group

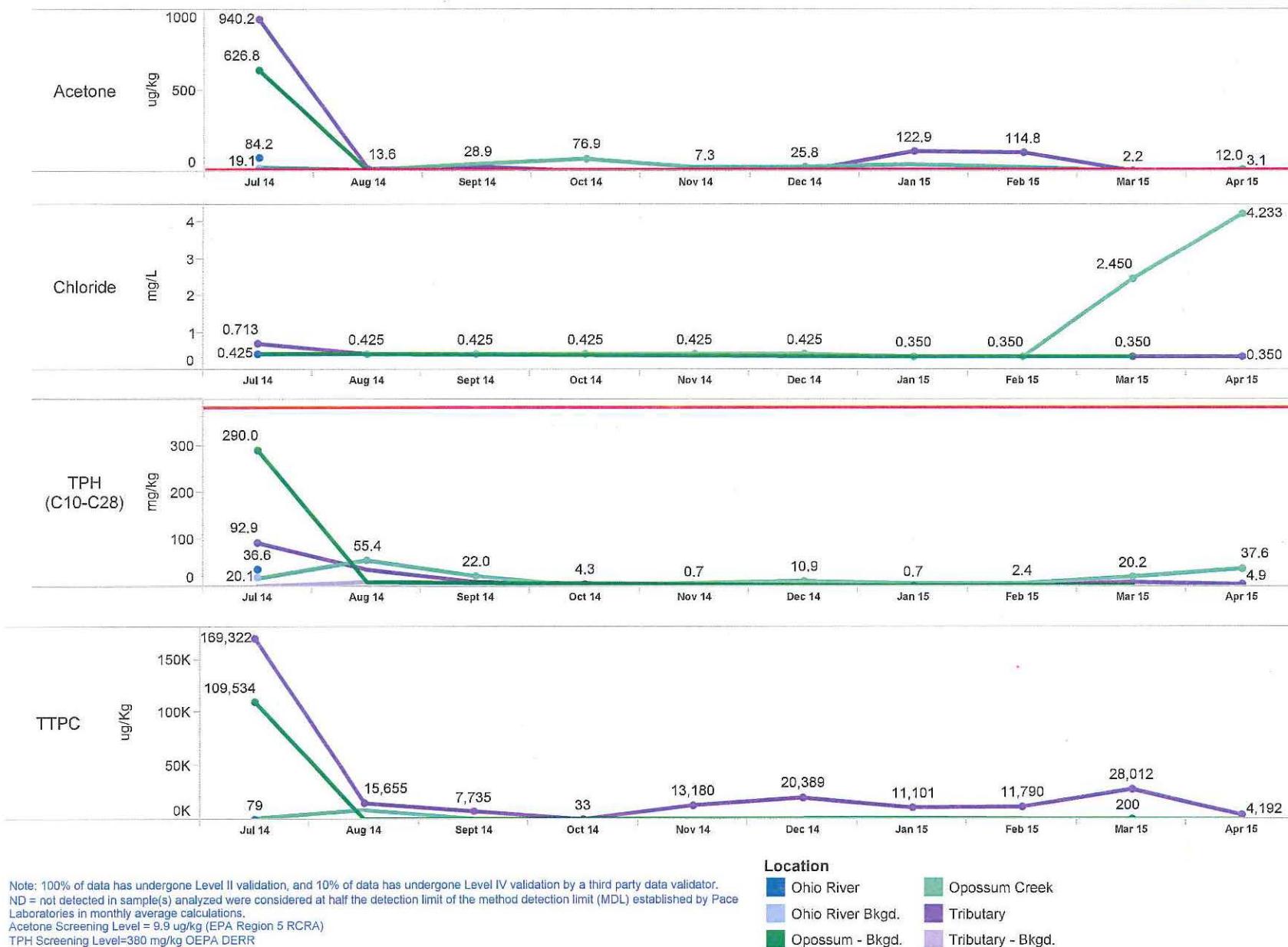
Ohio River	Opossum - Bkgd.	Tributary
Ohio River Bkgd.	Opossum Creek	Tributary - Bkgd.

APPENDIX A.3

Master Trend Graphs

Sediment

Sediment Monthly Averages



Note: 100% of data has undergone Level II validation, and 10% of data has undergone Level IV validation by a third party data validator.
 ND = not detected in sample(s) analyzed were considered at half the detection limit of the method detection limit (MDL) established by Pace Laboratories in monthly average calculations.
 Acetone Screening Level = 9.9 ug/kg (EPA Region 5 RCRA)
 TPH Screening Level=380 mg/kg OEPA DERR

APPENDIX B

Impoundment Location

APPENDIX B.1

Figure 2

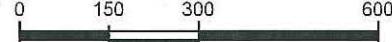
Impoundment Location Summary Map



LEGEND

- Eisenbath Pad Locations
- Eisenbath Pad

Scale:



1 in = 300 ft

Map References:

- USGS 7½ minute quadrangle: Round Bottom, OH.
- Stream layer provided by Ohio Geographically Referenced Information Program (OGRIP). <http://www.ogrip.oit.ohio.gov>.

Notes:

- This drawing is the property of Statoil USA Onshore Properties, Inc. and contains information that is proprietary and confidential in nature. It may not be copied or otherwise reproduced in whole or in part without prior written consent.

FIGURE 2:

IMPOUNDMENT LOCATIONS Eisenbath Well Pad Site

Project #: 14-467-LM

Prepared for :



Drawn by: ADJ

199 Johnson Road

Checked by: LM/MM

Building 2, Suite 101

Date: 7/14/2015

Houston, PA 15342

Revision:

Office: (724) 746-5200

Fax: (724) 746-5603

www.moody-s.com



Moody
and Associates, Inc.

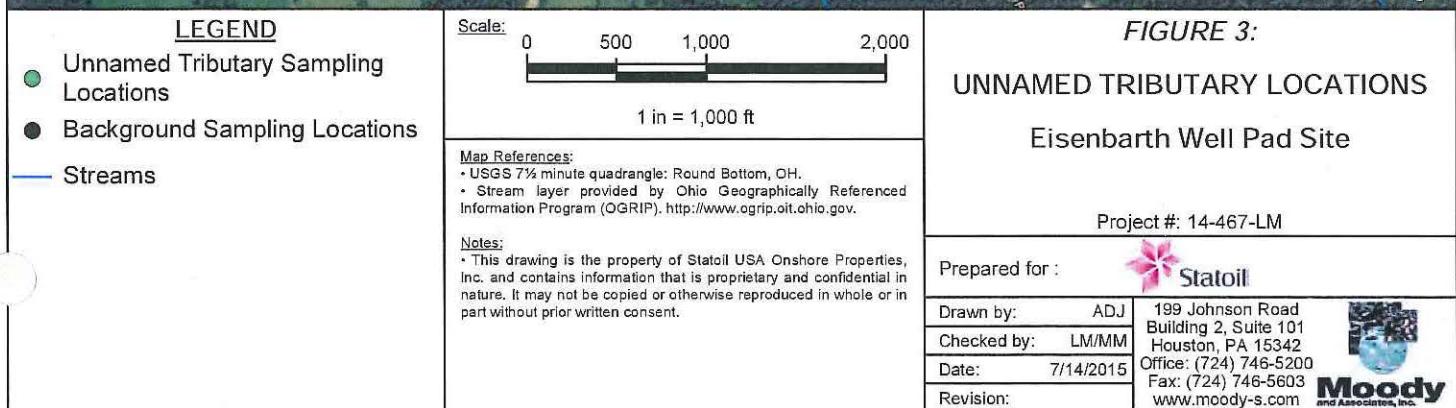
APPENDIX C

Unnamed Tributary to Opossum Creek

APPENDIX C.1

Figure 3

Unnamed Tributary Location Summary Map



APPENDIX C.2

Unnamed Tributary Trend Graphs

Surface Water

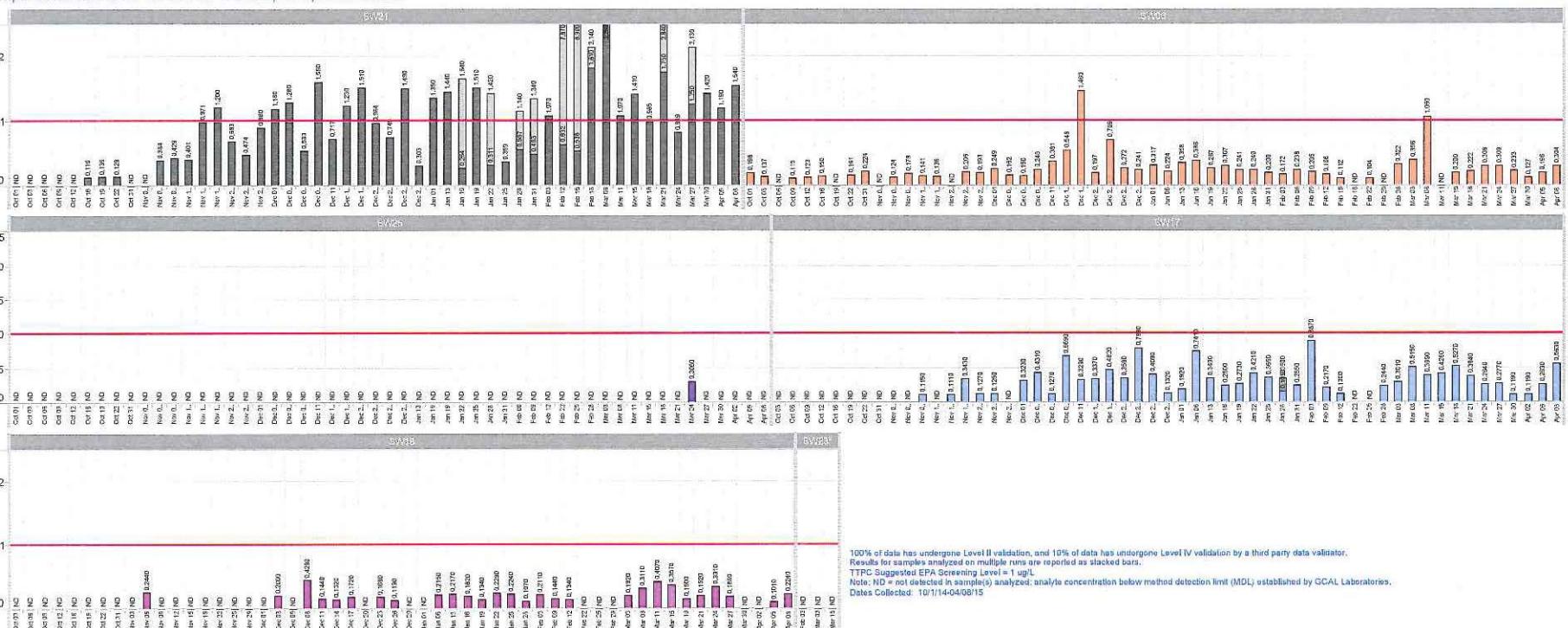
Surface Water - Unnamed Tributary to Opossum Creek

CTEH

Background



TTPC Surface Water Sample Concentrations - Unnamed Tributary to Opossum Creek



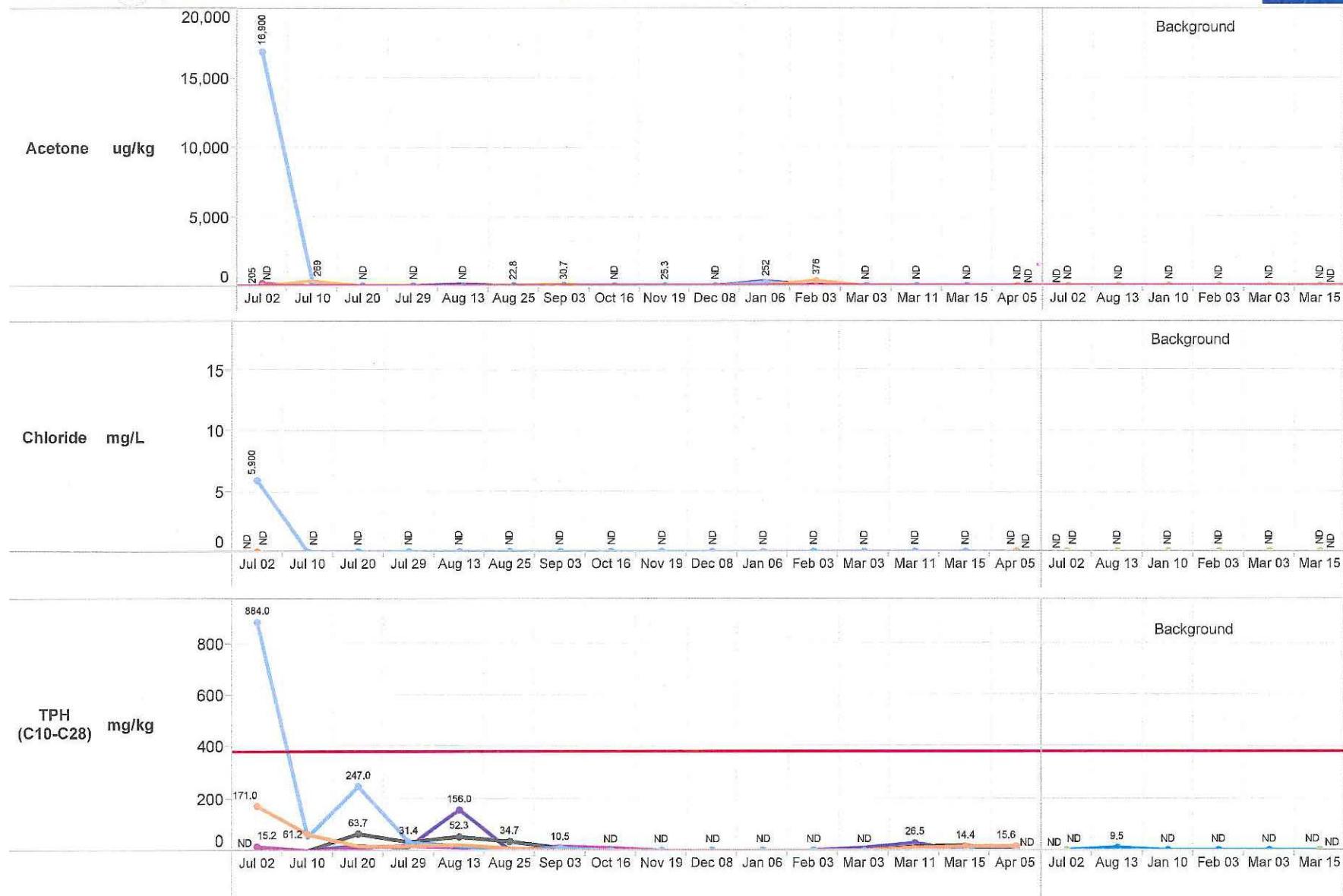
APPENDIX C.3

Unnamed Tributary Location Trend Graphs

Sediment

Sediment Sample Concentrations: Unnamed Tributary to Opossum Creek

СТЕН



Note: 100% of data has undergone Level II validation, and 10% of data has undergone Level IV validation by a third party data validator. ND = not detected in sample(s) analyzed; analyte concentration below method detection limit (MDL) established by Pace Laboratories.

Acetone Screening Level = 9.9 ug/kg (EPA Region 5 RCRA)

TPH Screening Level=380 mg/kg OEPA DERR

Dates Collected: 07/02/14-04/05/15

Location

SW06

SW17

SW18

ANSWER

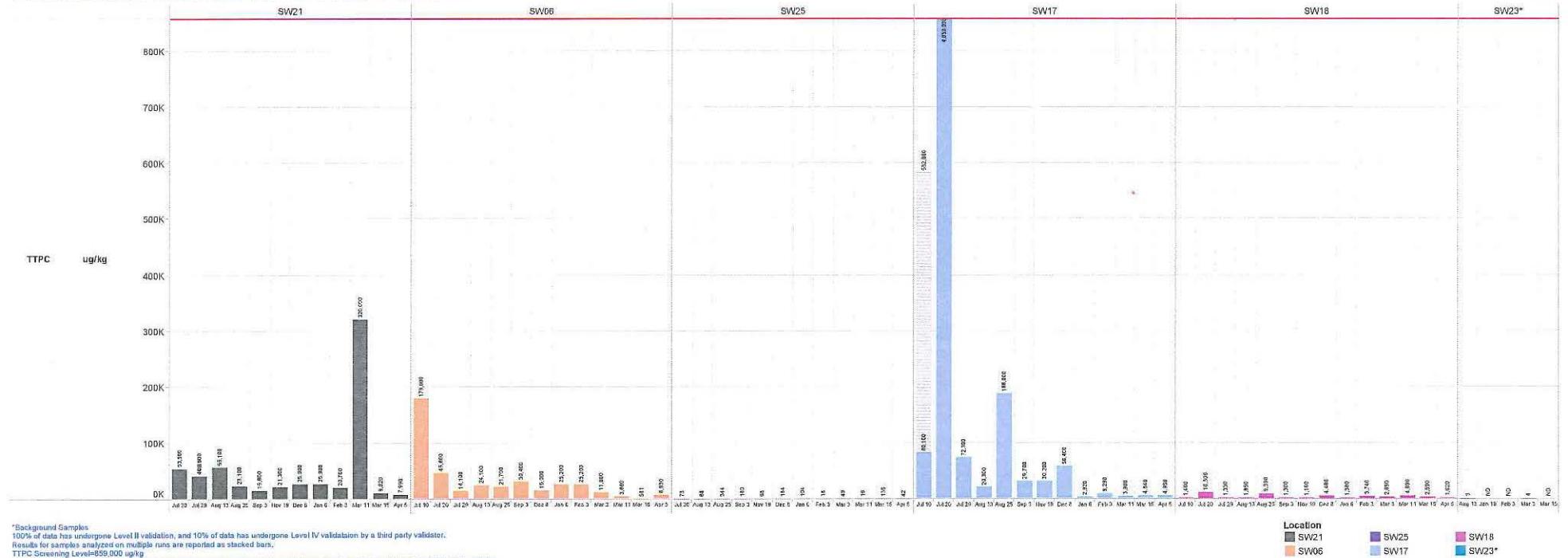
SW21

SW231

SW25

10 of 10

TTPC Sediment Sample Concentrations - Unnamed Tributary to Opossum Creek



*Background Samples
100% of data has undergone Level II validation, and 10% of data has undergone Level IV validation by a third party validator.

Results for samples analyzed on multiple runs are reported as stacked bars.

TTPC Screening Level=659,000 ug/kg

Note: ND = not detected in sample(s) analyzed; analyte concentration below method detection limit (MDL) established by DCAL Laboratories...

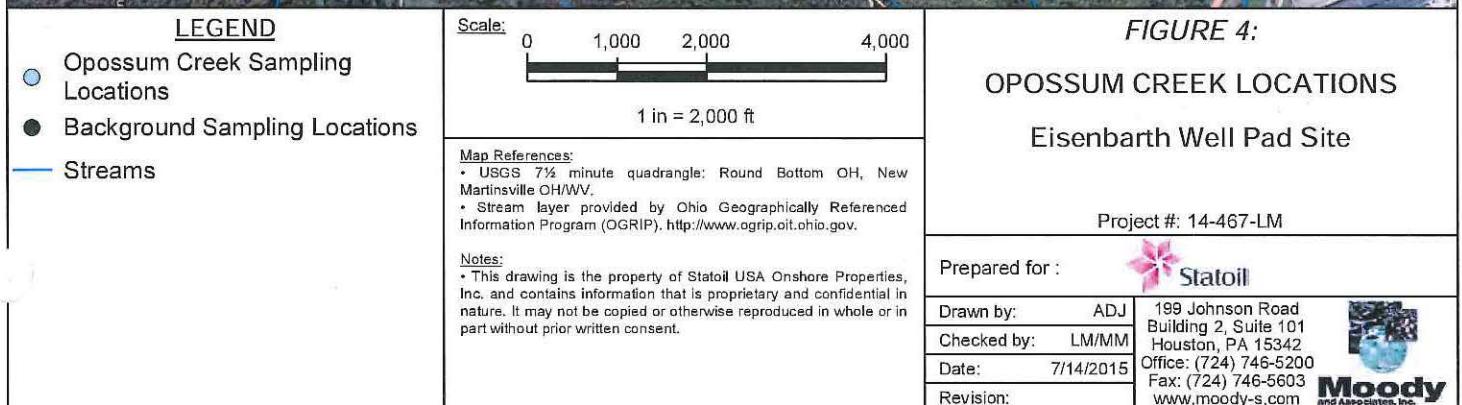
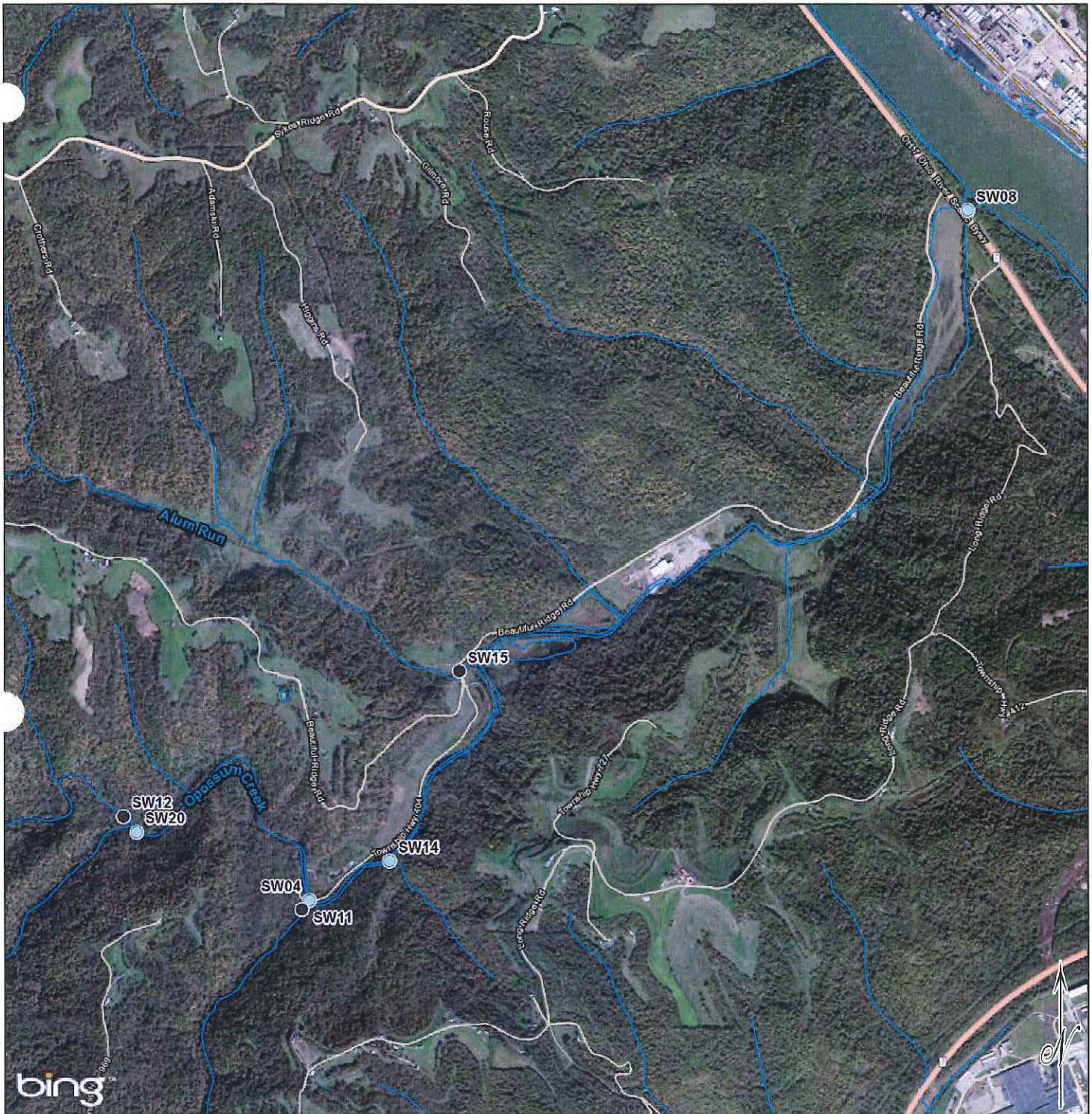
APPENDIX D

Opossum Creek

APPENDIX D.1

Figure 4

Opossum Creek Location Summary Map

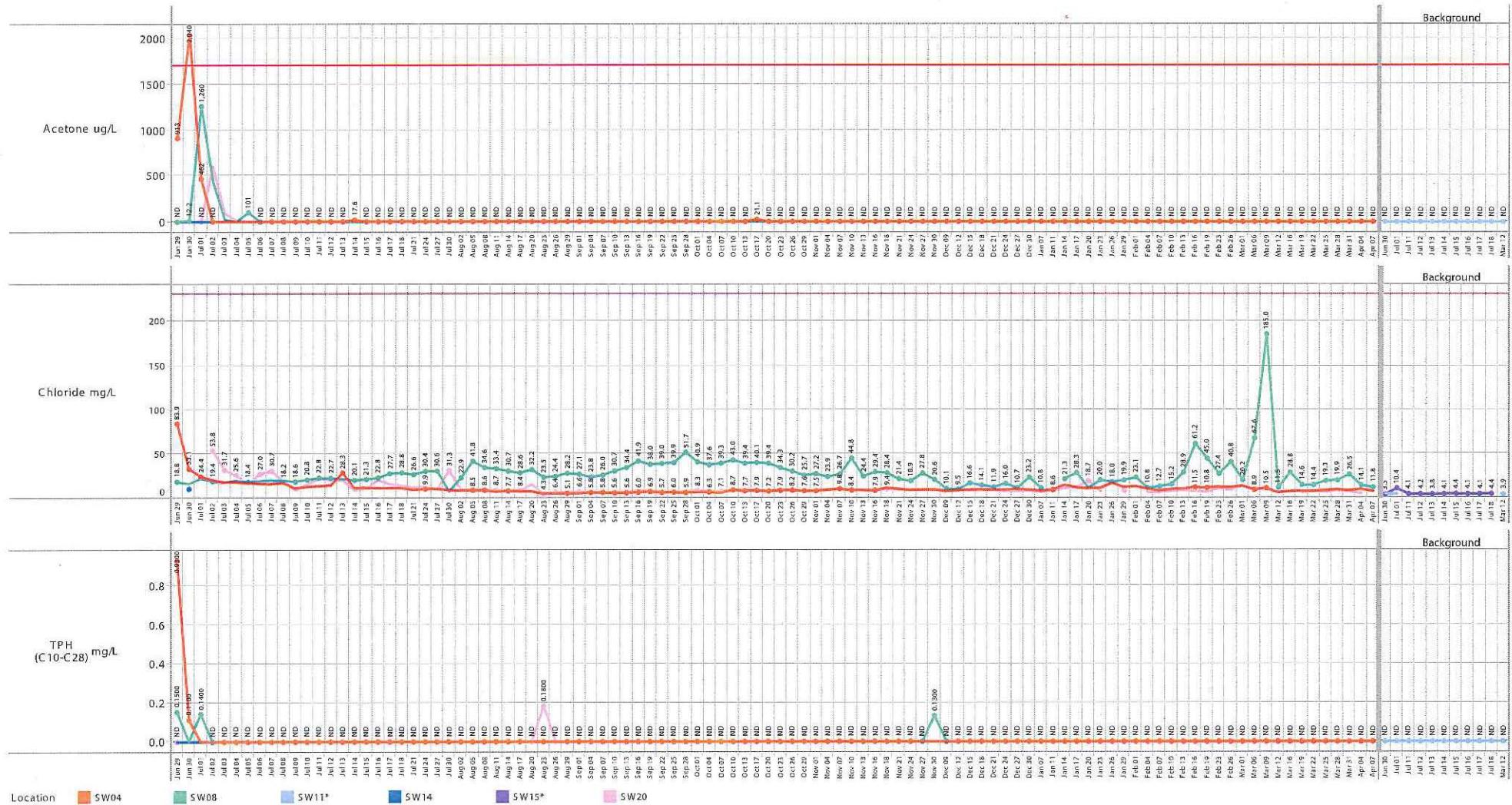


APPENDIX D.2

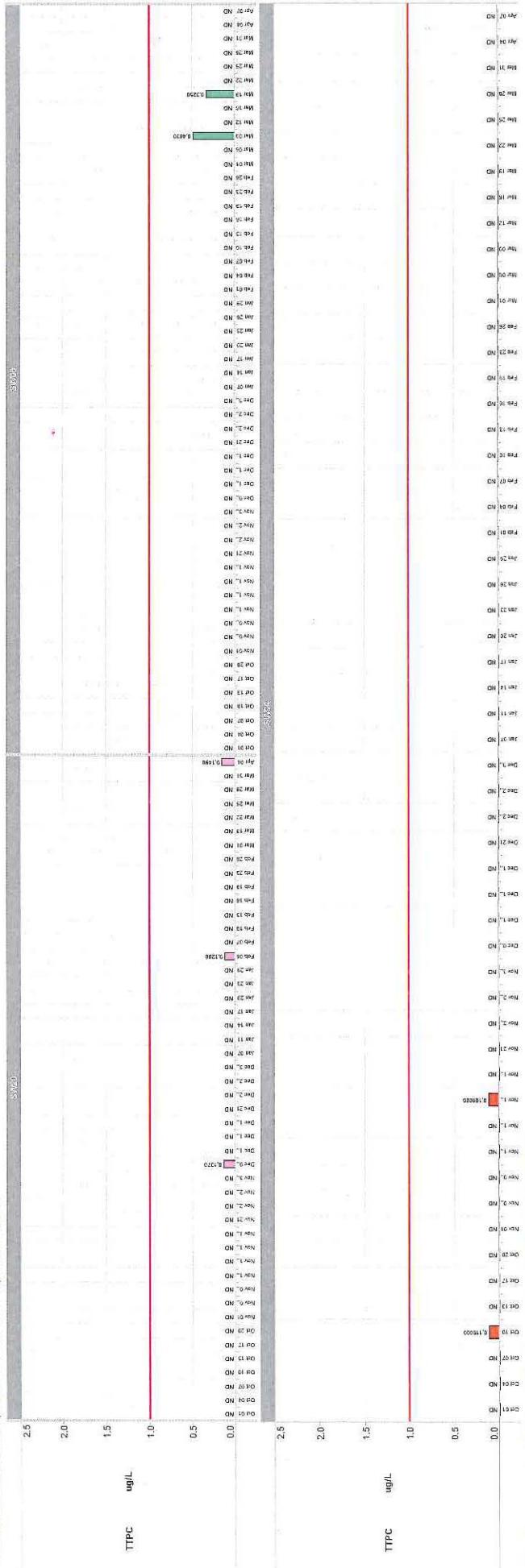
Opossum Creek Location Trend Graphs

Surface Water

Surface Water: Opossum Creek



TTPC Surface Water Sample Concentrations - Opossum Creek



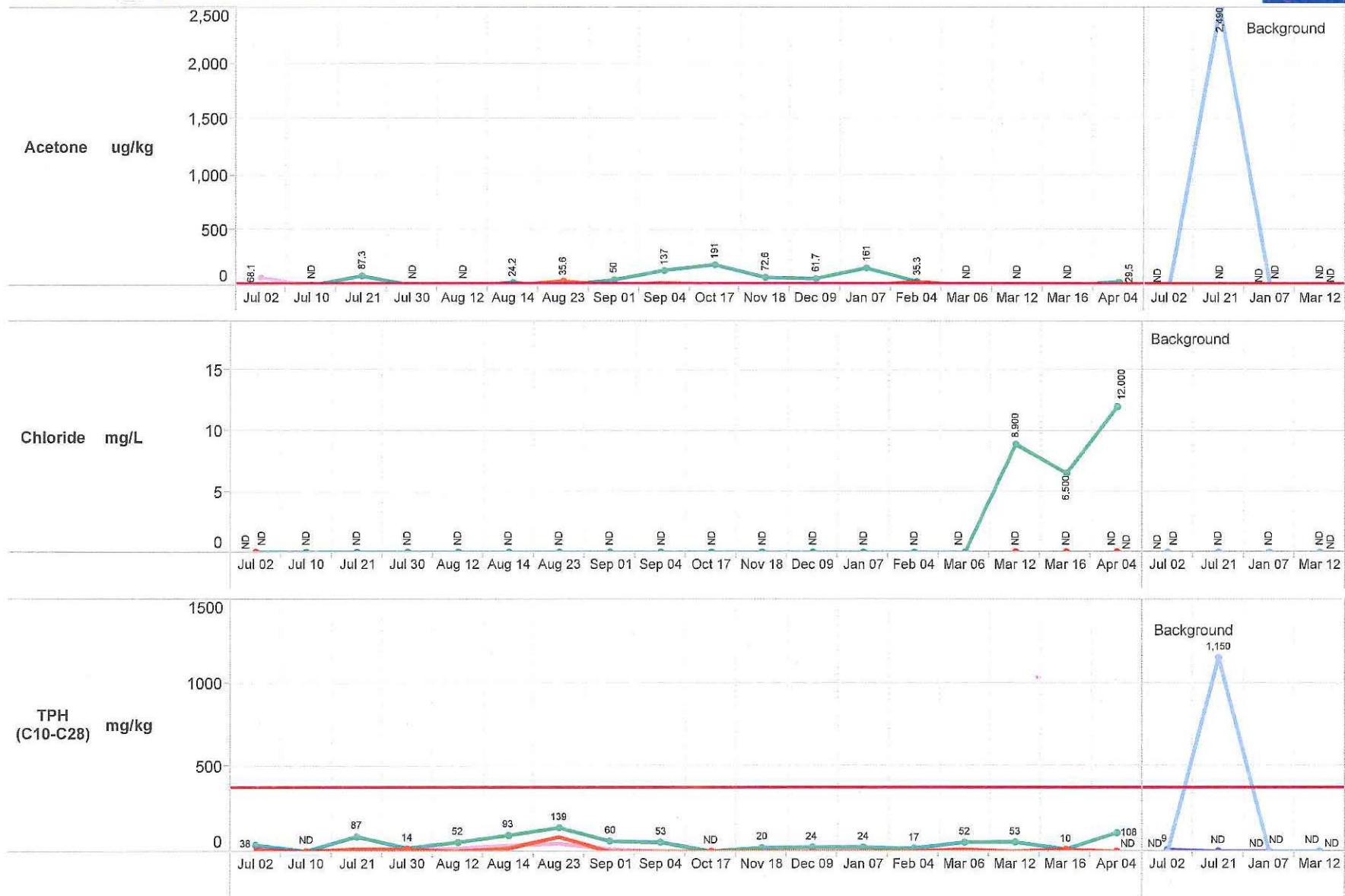
APPENDIX D.3

Opossum Creek Location Trend Graphs

Sediment

Sediment Sample Concentrations: Opossum Creek

CTEH

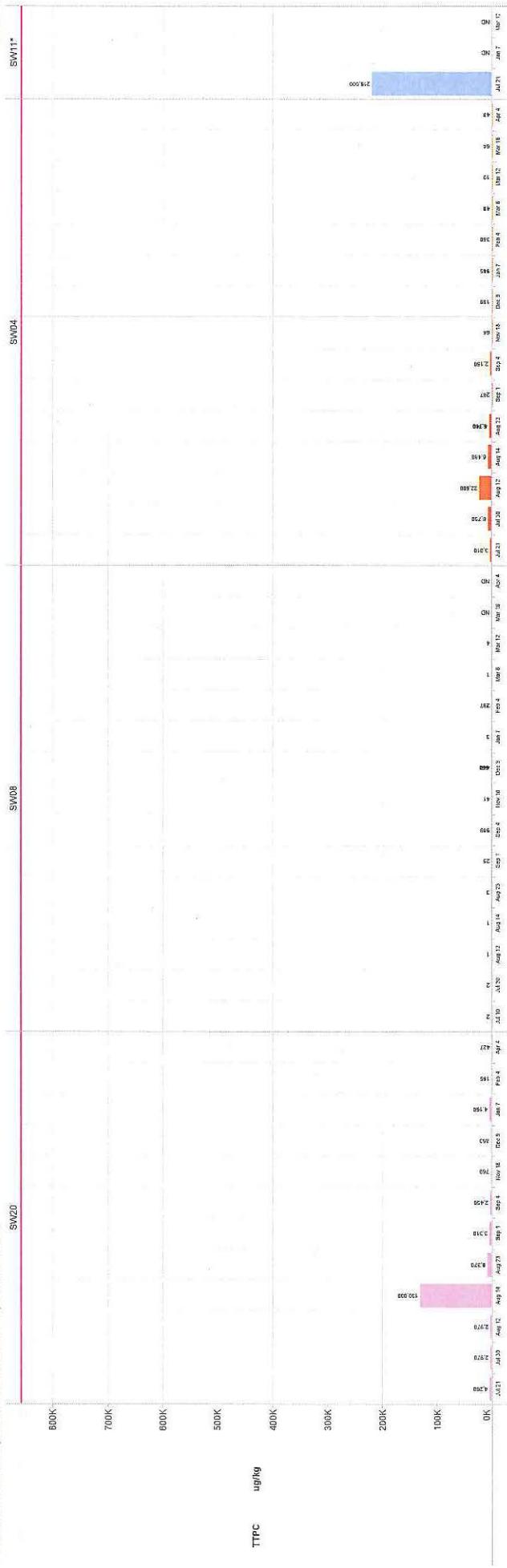


Note: 100% of data has undergone Level II validation, and 10% of data has undergone Level IV validation by a third party data validator.
 ND = not detected in sample(s) analyzed; analyte concentration below method detection limit (MDL) established by Pace Laboratories.
 Acetone Screening Level = 9.9 ug/kg (EPA Region 5 RCRA)
 TPH Screening Level=380 mg/kg OPEA DERR
 Dates Collected: 07/02/14-04/04/15

Location	SW04	SW08	SW11*	SW14	SW15*	SW20

TTPC Sediment Sample Concentrations - Opossum Creek

SW008 SW014



*Indicates Sample
100% of data has undergone Level II validation and 10% of data has undergone Level IV validation by a third party validator.
Results for samples analyzed in multiple runs are reported as a Revised bars.

TTPC Screening Level=55,000 ug/kg
ND = not detected in sample(s) analyzed; **analyte** concentration below method detection limit (MDL) established by OCAL Laboratories.

Dates Collected: 07/01-14/2011/15

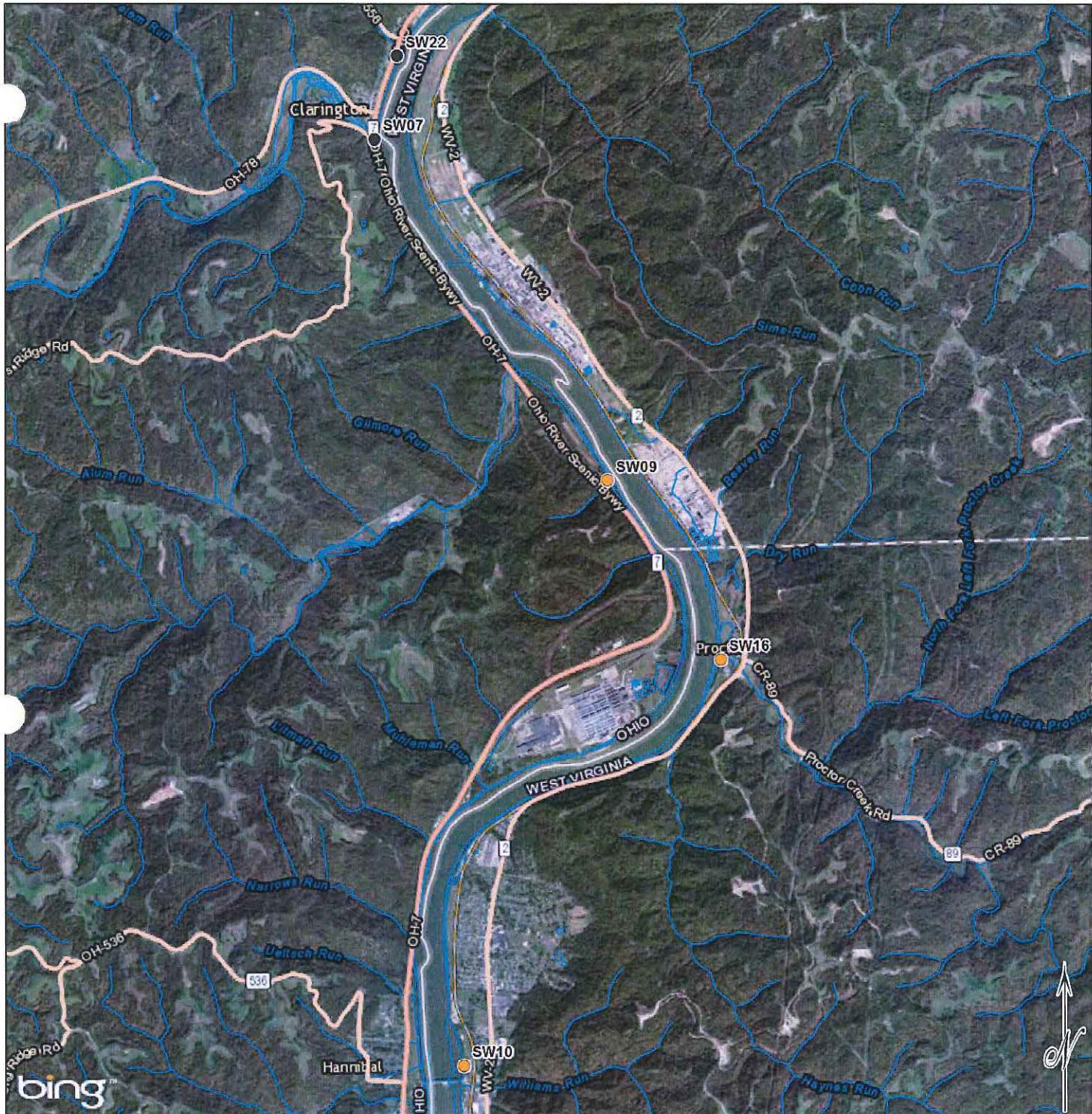
APPENDIX E

Ohio River

APPENDIX E.1

Figure 5

Ohio River Location Summary Map



LEGEND

- Ohio River Sampling Locations
- Background Sampling Locations
- Streams

Scale:

0 2,500 5,000 10,000

1 in = 5,000 ft

Map References:

- USGS 7½ minute quadrangle: Powhatan Point OH/WV, New Martinsville OH/WV.
- Stream layer provided by Ohio Geographically Referenced Information Program (OGRIP). <http://www.ogrip.ohio.gov>.

Notes:

- This drawing is the property of Statoil USA Onshore Properties, Inc. and contains information that is proprietary and confidential in nature. It may not be copied or otherwise reproduced in whole or in part without prior written consent.

FIGURE 5:

OHIO RIVER LOCATIONS Eisenbarth Well Pad Site

Project #: 14-467-LM

Prepared for :



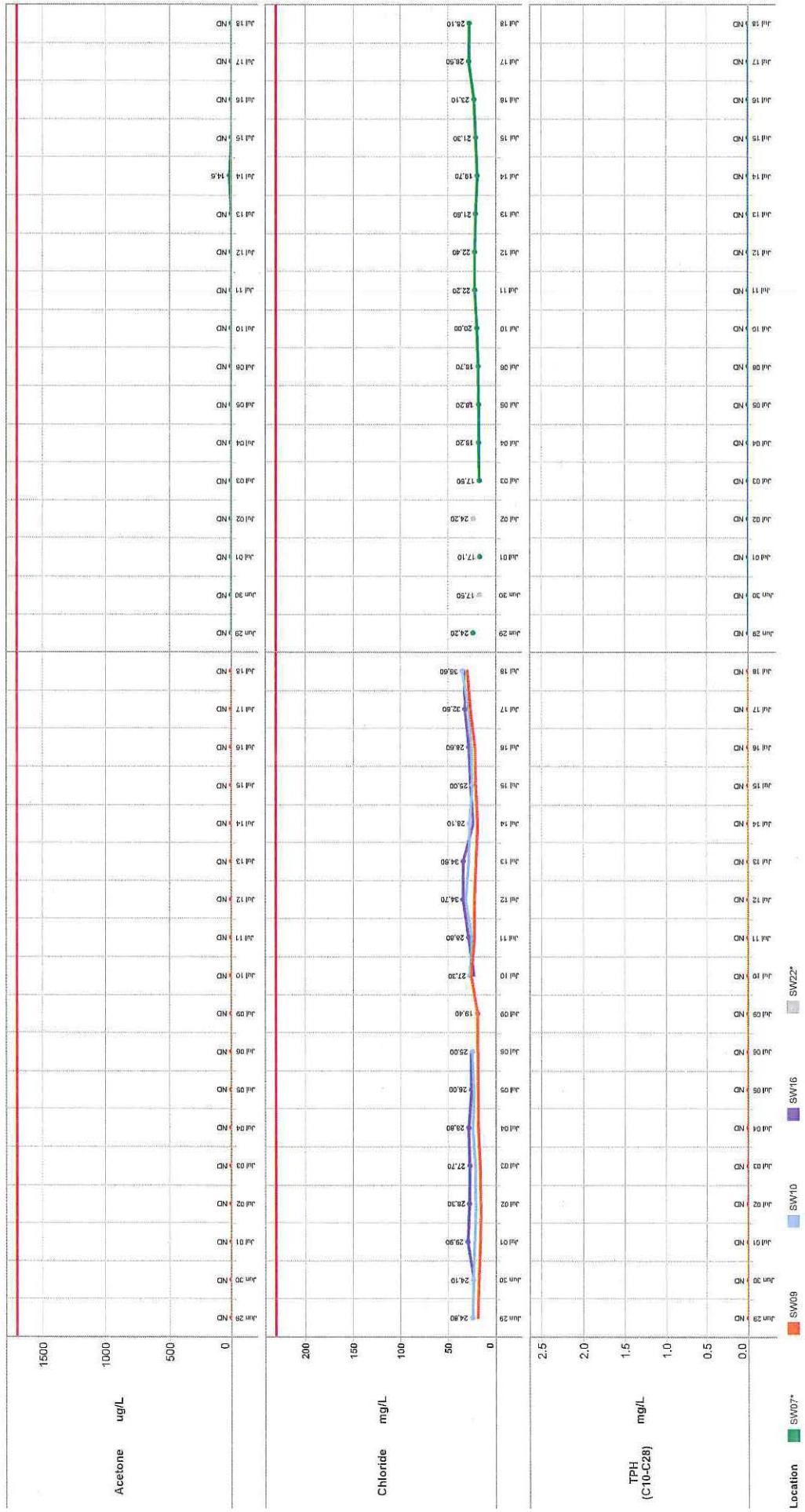
Drawn by:	ADJ	199 Johnson Road Building 2, Suite 101 Houston, PA 15342 Office: (724) 746-5200 Fax: (724) 746-5603 www.moody-s.com
Checked by:	LM/MM	
Date:	7/14/2015	
Revision:		

APPENDIX E.2

Ohio River Location Trend Graphs

Surface Water

Surface Water - Ohio River



Background Sampled at: CCC (Chronic) = ~230 mU/ml.
Antibody EPA Region 5 CLIA Screening = 1,200 U/ml.
Hence: 100% of data has undergone Level I validation and 10% of data has undergone Level IV validation by a third party validator.
Non-detects are shown as the laboratory method detection limit (MDL).
Data Collected: 06/29/2014 - 7/16/2015

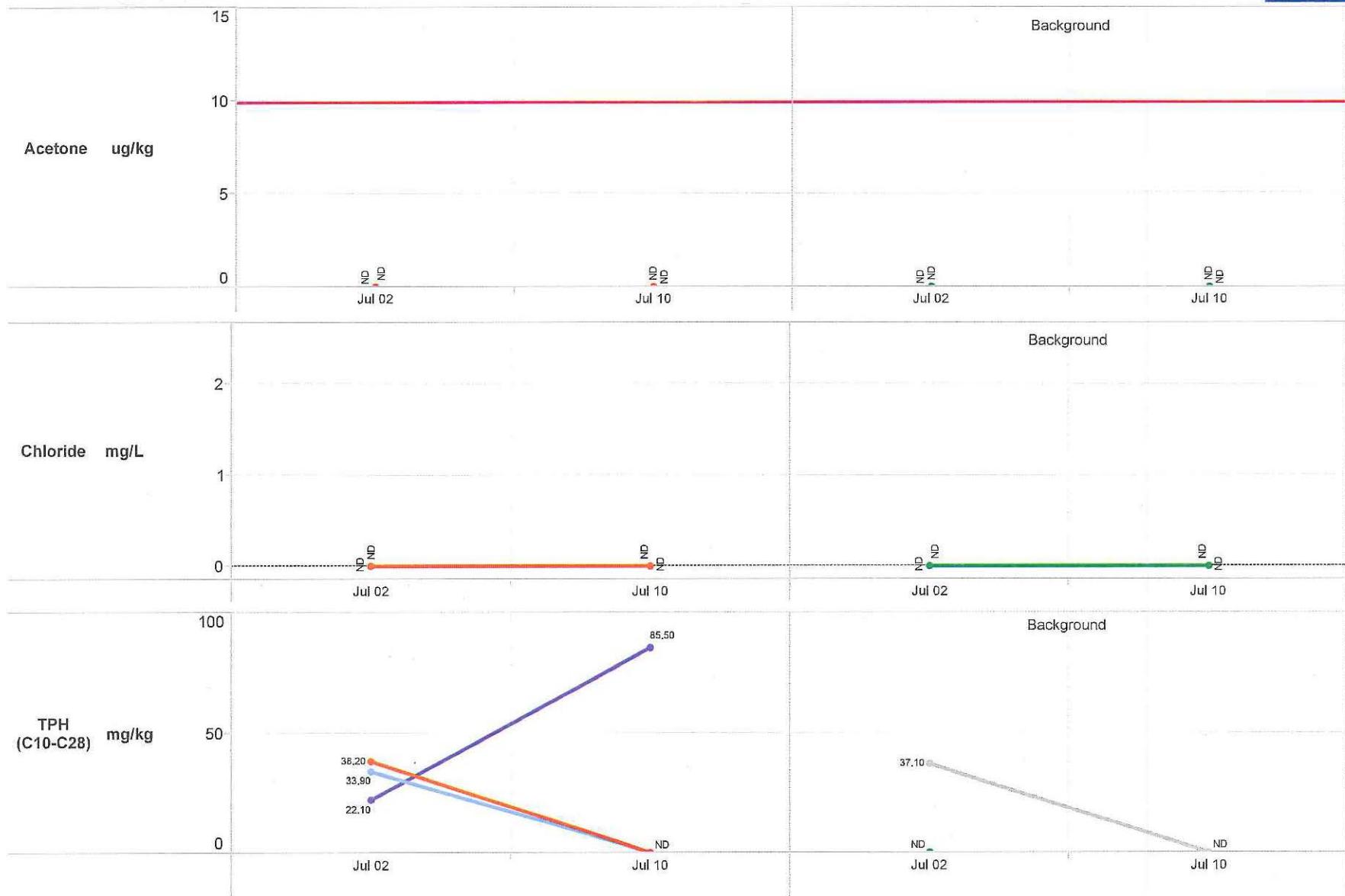
APPENDIX E.3

Ohio River Location Trend Graphs

Sediment

Sediment Sample Concentrations: Ohio River

CTEH



Note: 100% of data has undergone Level II validation, and 10% of data has undergone Level IV validation by a third party data validator.
ND = not detected in sample(s) analyzed; analyte concentration below method detection limit (MDL) established by Pace Laboratories.
Acetone Screening Level = 9.9 ug/kg (EPA Region 5 RCRA)
TPH Screening Level=380 mg/kg CEPA DERR
Dates Collected: 07/02/14-07/10/14

Location
■ SW07*
□ SW10
■ SW09
■ SW16

■ SW22*